

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXV.—No. 13.
[NEW SERIES.]

NEW YORK, SEPTEMBER 23, 1876.

\$3.50 per Annum.
[POSTAGE PREPAID.]

IMPROVED STONE-SAWING MACHINERY.

Since the discovery of the bort carbon, or black diamond, much skill and a vast amount of energy and capital have been expended to render it of practical value to manufacturing industries. It has long been known to scientists as one of the hardest substances in Nature; and it has been, and is still, used by lapidaries in cutting and polishing other precious stones, even the white diamond. It has also given aid to industrial science in improving the diamond drill, and more recently to the mechanic arts, in giving us new cutting tools for use on substances on which iron and steel were useless. But while its value for cutting hard substances, especially stones of various texture and density, has been known and appreciated, its practical utility has been impaired by a difficulty in harnessing it, that is, holding it securely for effective use. A large amount of inventive skill, time, and money has been expended in the attempt to accomplish this, with more or less success; but the attempts were generally entire failures, especially the attempts to saw and work stone. The records of the Patent Office, within the last ten years, show the various modes and appliances to this end; and the invention of Mr. Branch has been one of the most practical successes among all such machines.

The circular saw, taking into consideration its unlimited capacity in sawing lumber, was considered by most inventors as the one to which the diamond could best be applied for sawing stone. Mr. Branch's first patent, dated June 8, 1869, was for the insertion of the diamond into a steel or iron holder made in two parts, with recesses for the diamond, and provided with soft metal cushions for the diamond to rest in. These holders were then dovetailed into the edge of the saw disk, and compressed, by a wedging device, the diamond into the soft metal. This saw was a success so far as the cutting was concerned, but the diamond could not be held securely for practical work, and the project was abandoned. Others have attempted improvements on this by brazing the diamonds into iron or steel holders; but the results were no better. The soft metal cushions would yield to the pressure of the work, and the centrifugal velocity of the saw would throw the diamond away. Some inventors, seeing these apparently unconquerable difficulties, regarded the circular saw as impracticable; and attempts were made to apply the diamond teeth to the sash or reciprocating saw, claiming for it greater capacity in the sawing of large blocks. While this merit may be conceded to a limited extent, the reciprocating saw is not equal to the circular saw, either in quantity or quality of work performed; while the risk of losing the diamond was in no wise lessened, except by the use of a sieve or cage to catch the receding diamond, so that it might be again reset, to be again, as before, thrown out.

Mr. J. W. Branch, the inventor of the machine herewith illustrated, claims to have achieved the secure holding of the diamond in steel or iron holders, without the dubious aid of soft metals, and his Stone Monarch, as he calls this sawing machine, gives the circular saw the same prominence in relation to the stone-working industry as in that of wood-working.

The peculiar manner of inserting the diamond into holders, and these holders into the saw disks, is fully described in letters patent dated August 31, 1875; and the chief merit

of this invention is the perfect security given to the diamond under any velocity whatever. The diamond holders are simple in construction (Fig. 2), and are furnished either in the saws completed, or in duplicate, so that any that may become faulty, by undue pressure or otherwise, may be renewed or replaced. They can be inserted into the saw by any practical mechanic, if the saw in other respects be perfect, without his having the skill to set the diamond.

The mode of applying water for lubricating the saws in work, and washing away the grit and dirt, is novel, and is peculiar to these machines. The water is conducted through the center of the mandrel into chambers, and through radial orifices, A, in the saw collars on each side of the saw, causing the water to impinge upon the saw blade, and to be, by the centrifugal force, conducted to the cut. This effects three results: 1. Keeping the journals of the mandrel cool. 2. Keeping the saw cool and even in temperature, preventing all undue expansion. 3. Cleansing the saw from all grit and dirt produced in sawing.

The machinery for conveying the stone is perfectly under

without complication; and a large proportion of work required for building can be finished, ready for erection, without the aid of the rubber or hand labor. The saws, moreover, run at the periphery at an average velocity of 10,000 feet per minute, which effects great rapidity and perfection in cutting stone: the difference being due to the variable density of the stone to be cut, varying from 1 to 36 inches per minute, or per 10,000 feet run of the saw. The ordinary freestones and sandstones are sawn by these machines at the rate of from 6 to 36 inches per minute, and marble and limestones at from 3 to 18 inches per minute, or an average from 300 to 800 feet per day, making due allowance for handling of stone.

The manufacturers, Messrs. Branch, Crookes & Co., have on exhibition at the Centennial (section A 16 and 17, saw mill), two of their diamond circular saw stone machines, with the necessary traveling crane and facilities for handling stone. The two machines have 66 and 30 inch saws respectively. The 66 inch saw contains 84 diamonds, and the 30 inch saw 60 diamonds. These machines are kept in operation, practically illustrating what we

have already described; and they attract a great deal of attention from visitors to the Exhibition.

Patented to Joseph W. Branch, under dates June 8, 1869, May 27, 1873, and August 31, 1875. For further particulars and for descriptive circulars, address Branch, Crookes & Co., 114 and 116 Vine street, St. Louis, Mo.

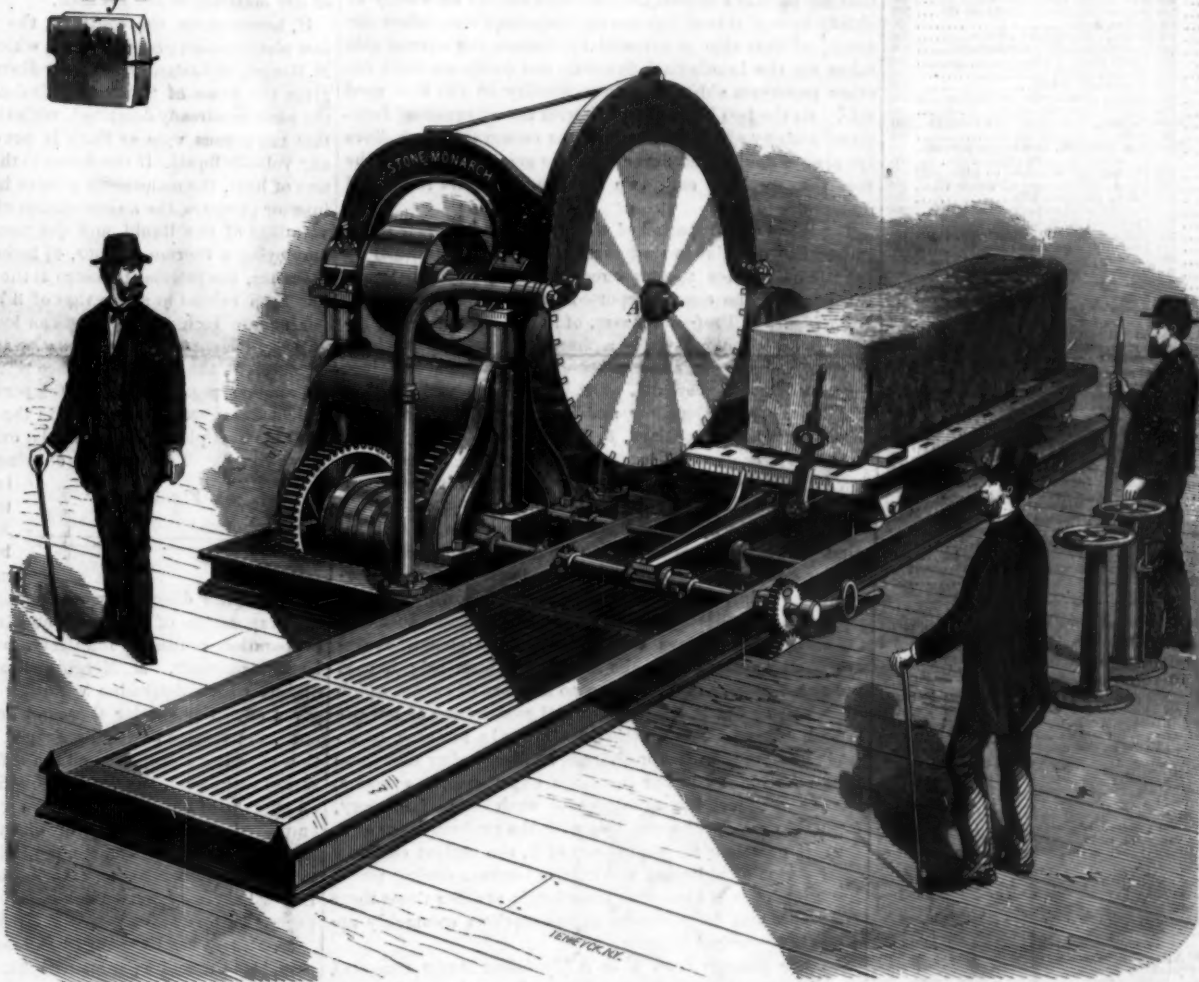
Melon Sugar.

Andros Island, in the long delta between the rivers Sacramento and San Joaquin, California, belongs to a group of low islands that are submerged at high water, and therefore not fit for culture. But when reclaimed by embankments they are exceptionally productive. Melons are a crop that never fails in this climate, and the factory on Andros Island can get melon juice from a vast area of melon country at small expense for transport. Watermelons with white pulp are preferred. They are planted twelve feet apart one way, and the other way six

feet apart. The leaves of the plants cover the ground and kill the weeds before they interfere. Besides, they make an impenetrable mulching, which keeps the soil moist and prevents baking. The melon juice is free from impurities, which make chemistry costly in beet sugar, is much less expensive, and the sirup is delicious. The seeds make oil, and the refuse is good for cattle. Taking account of so many advantages, sugar from melons, though rated at 7 per cent of the weight of the fruit, instead of 8 per cent allowed for beets, costs less to make. The difference may be set down as 5½ cents for melon sugar to 7 cents a pound for beet sugar. In regard to quality, melon sugar is superior. Unless extra care be used, beet sugar is apt to have an unpleasant buggy flavor.

Let it be understood that beets can only succeed in moist, bottom lands. Melons strike deep root, and they grow everywhere on our uplands. No doubt they would thrive luxuriantly in Jersey, Delaware, and Maryland. In the sandy soil of States South, no crop can be more certain, and Baltimore would make a convenient center for supplies of melon sugar works. Our California correspondent states that San Francisco sympathizes with Baltimore, and will keep her advised as to the success of the melon sugar-making industry.—Baltimore Sun.

Fig. 2



BRANCH'S DIAMOND STONE-SAWING MACHINE.

the control of the attendant, and is provided with a simple feeding device, adjustable to accommodate the variable texture or density of the stone to be sawn. The saws are also made adjustable relatively to the depth of cut, either entirely or partially through the block, preserving a straight line at the bottom of the cut, but allowing for moldings, rebates, etc.

The table to carry the stone is placed on a series of rollers set in the carriage, which provides for the easy adjustment of the stone at right angles with the saw, so as to cut off any thickness required. The carriages upon which the table is placed is also provided with rollers, fitted upon parallel V ways, and with a feed rack working upon a feed pinion.

It will be observed that there are no slides, and that the roller bearings and journals are all covered, so that the working parts are not impaired by any accumulation of grit or dirt. The saws are used either over or under the work, but preferably over for sawing large blocks and ashlar, and under for edging, crosscutting, and sawing small dimension stone. This range of use is due to the central application of water; as, by the centrifugal velocity of the saw, the water is always conveyed to the cut. In short, these machines are adapted to meet all the requirements of straight line work,

ple) was placed in air, while the free extremity of the petiole was placed considerably beneath the surface of water in a test tube. The apparatus being submitted to solar rays, nearly pure atmospheric air passed rapidly under the tube. This took place as if the leaf were a natural thermo-diffuser; and the phenomenon is purely physical in character. The respiration of animals may also be a similar phenomenon; but this has not been sufficiently demonstrated to warrant an affirmative assertion.

The facts of M. Merget's discovery are interesting both from a physical point of view, and in that they tend to explain effects of which the causes are as yet undetermined. They go to show, besides, the mutual interdependence of sciences, the domains of which formerly appeared absolutely distinct.

PRACTICAL INFORMATION FOR PRACTICAL MEN.

The leading article of the *Journal of the Franklin Institute* for August begins with the positive assertion that the general idea that practical information, useful to a practical man, can be made interesting or instructive to the ordinary reader is an altogether erroneous one. And after a six-page amplification of this discouraging thesis, based on the half century's experience of the *Journal*, the writer closes with the sweeping remark that there is an incompatibility, now and for all time, between practical and popular information.

Bearing in mind the warning of an American humorist: "Don't never prophesy unless you know": we would not venture to contradict the *Journal* with regard to the possibilities of "all time;" but for the time that now is, we do not hesitate to say that there is no such incompatibility. And further, an expression of thirty years in trying to meet the popular demand for practical information has given us an abiding conviction that, as in the past, so in the future, in a yearly increasing degree, practical information useful to practical men will more and more be desired by intelligent readers; and the success of periodicals devoted to Science and the arts will hinge more and more—as scientific thinking increasingly prevails—upon their presenting promptly, clearly, and sensibly the very information which the *Journal* asserts to be so essentially unpopular, that is to say, practical information really and truly considered. The impossibility of making attractive to the general reader the stuff which the *Journal* describes as alone worthy of that title, we should not think of doubting. The *Journal* has sufficiently demonstrated that it cannot be done. We doubt whether it could be done even for the ludicrously limited class of men to whom the *Journal* would apply the term practical; in its own words, a few specialists, each of whom "must have acquired, in the course of his practice in some particular direction of knowledge, enough to have compelled him to have learned its 'science,' regularly and methodically, to have investigated by his reasoning faculties and founded himself upon principles and not on half-comprehended facts."

The definition is not very grammatical nor very clear; but we gather from it, and from subsequent remarks, that the practical man must not only be a specialist in scientific investigation, but one so furnished with all that has been accomplished in his particular department that no information can be practical to him unless it is wholly original and presented along with the most thorough and elaborate reasoning and formulae that may be required for its support and demonstration. "It is the progress and advance of the arts and sciences, not the arts and sciences themselves, that the practical man needs information about;" and the method approved for the presentation of such additions to "practical" knowledge is the driest and most elaborate possible, albeit the investigation is "tedious," the discussion "recondite," and the concluding results "unintelligible, almost incomprehensible, to any others than practical men in an extremely limited kind of practice."

It is not surprising that the *Journal* finds an incompatibility between such information and popularity; but it is surprising to find an editor of intelligence coolly assuming that such information exhausts the limits of the practical, and that no man deserves to be called practical who does not delight in it. The position is sufficiently absurd to be grotesque.

WORKMEN AND THEIR INSTRUCTORS.

A hammer and a chisel are two very simple tools, and surely it seems there can be no great mystery in the use of two such implements; but a foreign language, or the groundwork of a whole science, can be learned in far less time than it takes to learn to chip a piece of metal an inch long so smoothly upon its surface that the chipping marks cannot be felt. The reason for this difference is simple, and lies in the fact the language or science has teachers who are masters of their subjects, and who make those studies the work of a lifetime; whereas the mechanic has as a rule to work out the whole problem for himself. It is as ridiculous for a man whose ten or fifteen years' experience has included the principles of construction, mathematics, mechanical drawing, etc., to assume to teach that intricate knowledge of manipulation necessary to make an expert workman as it would be for a workman who had spent his leisure time in reading books of science for instruction to attempt to instruct the scientific world; and this would have been made apparent long ago but for the lack of education so common to expert workmen, and but that, so soon as an expert workman attains the knowledge of his trade, and the skill in the use of language which enables him to enter the arena of debate or tuition, he ceases to be a workman and becomes too often a stranger to the workmen's interests. Such a faint concep-

tion of the real value of an unusually expert workman is possessed by employers that, if he possess such a qualification only, his sphere of usefulness is limited to his practice, and he would search the wide world in vain for a means of giving to others the benefits of his skill by imparting to them the minutiae of movements, processes, forms, time, speed, etc., which, combined, form that skill which is best known as manual dexterity. There never has been nor can there ever be a piece of expert workmanship done that was not governed by distinct principles and laws; and the misfortune is that they are to a very great extent unwritten laws. Volumes are written for the edification of the workmen that had better far never have had existence. Can the workman do aught but smile at the statement, given under assumed authority, to the effect that tools for cutting wood can be much harder than for cutting iron, or, to state it better, "tools for cutting wood are harder than those usually employed for cutting iron"? And what are we to think of the advice that "the better way to make a scraper" (for flat surfaces) "is to form it like a Venetian stiletto or a beech nut"?

Not long ago, a statement went the rounds of the mechanical press to the effect that a certain French mechanic had discovered a method of reducing the diameters of the tires of locomotive wheels by a process of partial immersion in water: whereas such was the practice twenty-five years ago, and it has been in common use ever since; principles governing the process, together with its application to wheel tires, having been published, together with an illustration, months before in the *SCIENTIFIC AMERICAN*. Instances of this kind are so numerous that it would take a volume to recite them, nor would the recital bring us any nearer to a solution of the question of how best to impart manual dexterity by means of instruction. Our knowledge of practical mechanics, as commonly applied in our machine shops, is crude in the extreme, and will continue to be so until we have placed within reach of the workman all the intricate knowledge that goes to the very bottom of expert workmanship, which information can only be obtained by practical experiment, made by men chosen by reason of their mechanical skill, under the directions of teachers capable of explaining and formulating the principles and rules governing the practice of the skillful artisan.

BORN SCIENTISTS.

The importance of the innate tastes of an individual being considered in determining the choice of a trade or profession is well shown in Mr. Francis Galton's recent work on the antecedents of English men of science, a volume prepared as a sequel to the treatise on "Hereditary Genius" already reviewed in these columns. Mr. Galton adopted the excellent plan of a well chosen series of questions, which every scientist was requested to answer and return to the sender. One hundred and eighty scientific men were thus questioned, and the replies which most appeal to the thoughtful are those relative to prevalent tastes. We should expect to find a taste for mechanics among the physicists, and such is the case: the same among the mechanicians and engineers. The underlying cause of scientific research may be traced in the repeated mention of the possession of a "desire to know facts," curiously coupled in some cases with a strong repugnance to works of fiction. More interesting, however, is the schedule of influences and motives which urged the various individuals to follow scientific pursuits. Out of 191 people, innate taste for their calling influenced 59; fortunate accidents (generally showing innate taste), 11; indirect opportunities and indirect motives, 19; professional influences to exertion, 24; encouragement of scientific inclinations at home, 34; influence and encouragement of friends, 20; of teachers, 13; travel in distant regions, 8; residual influences, unclassified, 3. The large plurality in favor of innate taste is striking. Now take the various callings: Out of 26 cases of physicists and mathematicians, 12 had an innate taste, 1 no natural taste at all and 7 are doubtful. Of 11 chemists, the taste of 5 was innate, 1 not, and 5 doubtful; of 8 geologists, 7 innate, 1 doubtful; of 24 zoologists, 17 innate, 3 not, 4 doubtful; of 10 botanists, 8 innate, 1 not, 1 doubtful; of 7 medical men, 2 innate, 4 not, 1 doubtful; of 6 statisticians, 3 innate, 1 not, 2 doubtful; of 5 mechanicians, 3 innate, 3 doubtful.

It is clear from this that a strong and inborn taste for science is both a prevailing and an enduring peculiarity of the persons considered. A fair estimate for Mr. Galton's deductions is that out of every ten men of science, six were naturally gifted with a strong taste for scientific pursuits. Not one person in ten, taken indiscriminately, possessing such an instinct, it follows that its presence must add five fold to the chance of scientific success.

The possession of a special taste for any pursuit is therefore a gift of Nature not to be slighted, and it is in fact something to be seriously studied and its development advanced.

EDUCATED FARMERS.

If we were asked to point out any especial fact as denoting beyond all others our rapid progression in knowledge and in civilization, we should select the strong tendency everywhere manifest to abolish empiricism in all pursuits of life. It is not very long ago that the physician administered his remedies blindly, and knew less of the functions of the heart than does his modern descendant of the spleen and gall bladder. Meteorology, most fickle of all sciences, based as it is on the most changeable of all things, the weather, has within a very few years made marvelous strides; and we are certainly advancing to a point when it will be

as easy to foretell the rain and storm of tomorrow as to remember the fine weather of yesterday. Even cookery is no longer to be the science in which inaccurately compounded ingredients, under constantly varying conditions, are supposed by some pleasant fiction to yield invariable results for has not a college been endowed, to educate our future *chefs de cuisine*? Thumb rules in every trade are now scouted by intelligent working men. The world has shaped itself into a gigantic point of interrogation; "why" is the question of the hour, and faith in things earthly is confined only to those who, like the deluded partisans of Keely and others of his ilk, mistake ignorance of that which is possible for belief in that which is not.

Of all the sciences, none within recent years has so quickly emancipated itself from the fogs of empirical conjecture as that of agriculture. Up to the end of the last century even, people believed that air, water, oil, and salts were the sources of plant nutrition. Wallerius, Bergmon, Pallas, Davy, De Saussure, and Sprengel contributed discovery after discovery, investigation after investigation, but their work was scattered and little known outside their laboratories. It was reserved for the genius of Liebig to unite all these fragments of truth; but it was not until 1840 that he produced his great work "Chemistry in its Application to Agriculture and Physiology," and thus gathered in concrete form the materials which are the basis of a now great and rapidly growing science. It is hard to realize that agricultural chemistry has found its application for but 26 years, so clearly are its benefits before us in tangible form. But on the other hand, this only serves to indicate to us how vast must be the results yet to come, when agriculture, through the instrumentality of its knowledge, shall have become in its turn as exact as its sister sciences, and as susceptible of being taught and learnt in the same manner as they. And to attain this much desired end, our schools and colleges, under the guidance of far-seeing men, are doing splendid work.

The youngest of our universities, Cornell, established an agricultural department three years ago, under the charge of Professor Roberts, the farm consisting of 150 acres, in not over good condition. Upon this tract of land the whole science of raising crops, as well as the business of managing a farm, is taught with a thoroughness which we doubt has ever been exceeded. Eighteen square rods of clover, for instance, are set apart for eighteen different modes of treatment with fertilizers. In the experiments with corn, three rows of each kind, or of each mode of manuring, or of the different modes of management in other respects, extend across the field. There are also experimental strips of oats and wheat; and thus every method of cultivation of all the farm products incident to our climate is practised directly before the student, who is required personally to perform the labor necessary in connection therewith. The results of the experiments are carefully recorded and stored away until sufficient shall have been gathered, over a number of seasons, to justify the determining of accurate averages.

Besides this, the students are taught a complete system of accounts. Every hour of labor hired, every product of farm sold, is minutely registered. The food which live stock consumes is recorded on one side and balanced yearly by the market value estimated by a skilled butcher. So that, in this way, the gains or losses, not only of the farm as a whole, but of every branch, are known with the utmost accuracy. Every student is required to become proficient in this account keeping. Each keeps his books separately, and determines estimated values; and as he may sell his own labor to the farm, outside the time required of him, which is but two hours and a half for two days of the week, he is directly interested in the task. Besides the farm, there is a garden of six acres, conducted under the same admirable system; and in addition, lectures on practical agriculture are given four times weekly by Professor Roberts. The *Country Gentleman*, to which we are indebted for these facts, states that the number of agricultural students is still too small, so that there seems to be abundant opportunity for all who may desire to acquire a thorough and most valuable education. Certain it is that such instruction is most urgently needed in this country. It has become too much the fashion for young men to crowd into the great cities, and there to eke out lives behind desks and counters which should be spent in developing the vast resources of the thousands of square miles wherein the richest soil on earth awaits the plowshare. In the Centennial Exposition are exhibited actual glass-enclosed sections of prairie soil with the black unctuous loam extending downwards far below the reach of the deepest furrow. Go look at that superb exhibit in Agricultural Hall, and think of the possibilities which educated farmers cultivating such land might accomplish. Think of it, stalwart young men, who meditate coming into the city after the present harvest is garnered, to find work where there is none to be had. Expend your labor and means at Cornell, Amherst, Dartmouth, and other like colleges, and obtain such an education as we have described then; "go West," pre-empt your land, and start on the high road to independence and ultimate fortune.

Crystallized Glycerin.

Dr. Armstrong recently exhibited, at a meeting of the Chemical Society, London, a specimen of pure crystallized glycerin. The solidification took place while the glycerin was being agitated on a railroad journey in cold weather last winter. Dr. Odling mentioned the curious fact that hydrocyanic or prussic acid is an excellent test for the purity of glycerin, the slightest admixture of any foreign substance causing the glycerin to turn yellow in a short time if a little hydrocyanic acid be stirred into the liquid.

IMPROVED APPARATUS FOR LINING INSOLES OF BOOTS.

Mr. Charles Monahan, of St. John, N. B., proposes to apply the linings of boots and shoes in a quick and perfect manner by an improved machine, which we illustrate herewith.

There is an upright post, to the top part of which the last, B, is securely attached. A metallic guard, C, extends around the last, and is attached to a support, D, that slides on the upright stand. The support, D, and guard, C, are forced in upward direction, to project above the last, by a strong spiral spring, D'. The pasted lining is placed bottom upward on the last, and prevented from sticking to the boot by the guard, while the boot is drawn over the last. The guard is kept in position by its spring until the boot is in position to be pressed on the last. The boot forces the guard down, and presses the lining firmly on the insole of the sole, so that it sticks to the same in an even manner. The boot is then taken off, a new lining placed on the last, and the next boot brought down. This invention was patented through the Scientific American Patent Agency, July 4, 1876.

Powder for Producing Ozone.

"In order to produce artificial ozone, Mr. Lender makes use of equal parts of peroxide of manganese, permanganate of potassium, and oxalic acid. When this mixture is placed in contact with water, ozone is quickly generated. For a room of medium size, two teaspoonfuls of this powder, placed in a dish and occasionally diluted with water, would be sufficient. The ozone develops itself; it disinfects the surrounding air without producing tough."

The attention of the writer was called to the above article as it appeared in the *Philadelphia Medical and Surgical Journal*, under date of May 20, 1876. For the purpose intended, it is certainly one of the best of the published formulae, but, on account of the danger attending its manipulation, should be used with extreme caution. A prescription with these proportions was taken to an apothecary, who inadvertently used a mortar in mixing it, with the result of an immediate explosion, which would have been attended with disastrous consequences except for the smallness of the quantity employed.

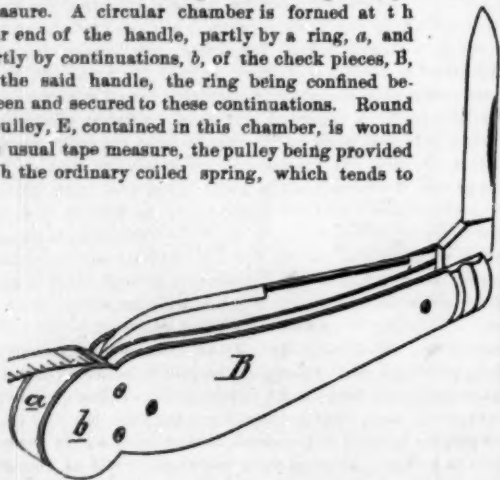
In mixing these ingredients, trituration should not be used at all, but they should be cautiously mixed with a spatula in small quantities; and even then, if they should have been reduced to a fine powder, they cannot be mixed without danger, as the mixture is liable to explode at the moment of contact.

Apothecaries who are not deficient in knowledge are sometimes deficient in caution, and articles published in reliable journals are copied and used without hesitation, and the compounder or dispenser is brought into unlooked-for and unexpected difficulties.

The above article is written solely with a view of placing druggists and physicians on their guard in using or dispensing a dangerous compound.—*John L. Davis, in American Journal of Pharmacy.*

COMBINED KNIFE AND TAPE LINE.

Mr. Glover S. Hastings, of Unionville, Conn., has patented (July 27, 1875), a combined pocket knife and tape measure, so constructed that the handle of the pocket knife is made available as a casing for containing the tape measure. A circular chamber is formed at the rear end of the handle, partly by a ring, a, and partly by continuations, b, of the check pieces, B, of the said handle, the ring being confined between and secured to these continuations. Round a pulley, E, contained in this chamber, is wound the usual tape measure, the pulley being provided with the ordinary coiled spring, which tends to

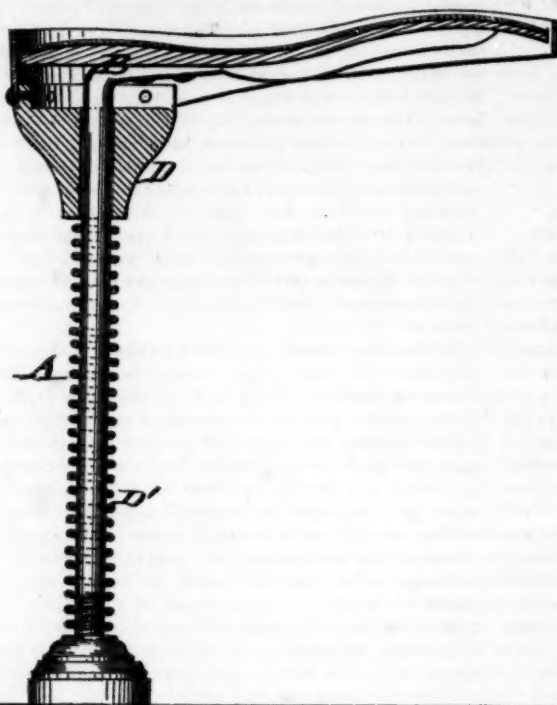


maintain the graduated tape within the chamber in a manner too well known to need description.

New Coal Fields in Utah.

Professor J. E. Clayton has returned from an extended visit to the coal fields in Wasatch county, Utah, and gives us some interesting and valuable information in relation thereto: "The coal mines are the first of the extensive series that stretch south through San Pete county. They are situated in Pleasant Valley, and are reached by going 40 miles due east from Spanish Fork station up the cañon to the summit, and thence south seven miles to the south end of the valley, making a total distance of about 105 miles from Salt Lake city, 58 of which are by rail. The wagon

road of 47 miles is easy, there only being about two miles of up grade from the mines to Spanish Fork city. The rest of the way is down the cañon on an incline averaging 66 feet to the mile. The highest altitude on the road is the summit of the cañon, which is about 7,750 feet above the level of the

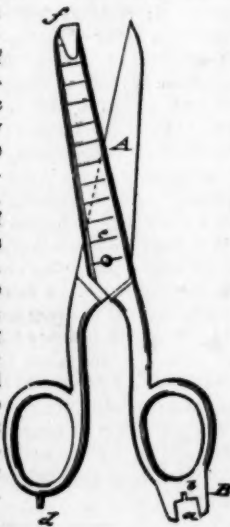
**APPARATUS FOR LINING INSOLES OF BOOTS.**

sea. Pleasant Valley is at the head waters of Price's river, which ultimately flows into the Colorado, and is about four or five miles long by two or three in width. At its lower end, numerous cañons put into the valley; and at the base of the hills around these, the coal shows in a semicircle west and east around the valley for six or eight miles. Two, and in some places three, beds show one above the other; the principal one, the Hutchings, being 32 feet in thickness and lying horizontally on the east side of the valley and trending to the south east. The region is cretaceous sandstone, and the Hutchings shows a foot wall of light gray sandstone with a yellowish gray sandstone roof. In the neighborhood is but very little shale, there being no shale seams whatever in the coal bed. No iron is visible, although higher up in the mountains is seen ferruginous sandstone, which, however, indicates nothing permanent. About one half of the bed of coal is of an excellent coking variety, the specimens we saw, though made in a primitive manner, being equal to the best imported. The coal beds are at an altitude of about 7,550 feet.

The surrounding hills have fine pine timber in sufficient quantity for local purposes, while an abundance of water is close by. Considerable importance can be attached to these coal fields for their accessibility, their great extent, and the coking qualities of their product.—*Salt Lake Weekly Miner.*

NEW COMBINATION TOOL FOR SEWING MACHINES.

We illustrate herewith an ingenious arrangement of all the tools, used in the care and adjustment of sewing machines, in a single implement. It is the invention of Clara A. Rogers, of New Orleans, La., and was patented through the Scientific American Patent Agency, July 11, 1876. The tools combined are a scissors, wrench, needle straightening device, throat plate mover, screwdriver, and measure. One of the handle parts of the scissors is provided with an extension, B, that has a square recess, a, for the purpose of serving as a wrench, the stocks of the scissors serving as handles. The recess, a, is further provided with a short and narrow slot, b, which serves for the purpose of straightening bent needles. The other scissors handle has an extension pin, d, by which the throat plate of the machine, whether of glass or metal, may be readily moved without the use of a separate tool. One or both stocks of the scissors may be graduated to form an inch or other measure, e, which is very handy, as the scissors are at any moment available; and the end of the broader stock is made tapering to form a screwdriver. The whole forms an exceedingly convenient and useful tool.



SILVER discoveries have been made in the vicinity of Arthur's Landing, on the north shore of Lake Superior, about 200 miles northeast of Duluth. A miner dropped down upon some crumbled quartz containing native silver. The rock is expected to yield \$3,500 or \$5,000 per ton.

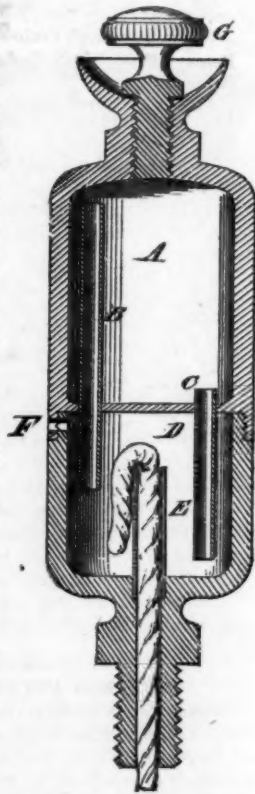
What a British Centennial Judge Thinks of Us.

The *London Times*, of August 14, gives unusual prominence to a letter written by an English judge at the Centennial, which the *Philadelphia Ledger* copies, and of which it also gives the substance in an editorial as follows: Captain Galton, the judge, says that he saw enough there to convince him that American manufactures had been making remarkable strides during the past twenty years. Captain Galton is one of the engineers appointed by the British Board of Trade to survey railways and other public works before they are opened for public traffic; and he was a British judge in the group of railway appliances, and immediately upon his return home he penned this letter. He had previously visited this country twenty years ago, and during the interval we all know that American manufacturing progress has been remarkable. He speaks of the great advance in our industries as shown by the growth in the amount of coal mined, and says that our higher wages, compared with England, are counterbalanced by the use of machinery to an extent much exceeding that generally in use in England. Observing the substitution of steel for iron rails on our railways, he candidly remarks that the new rails are almost all made in the United States, and that it is not probable that England will be called upon much longer to supply us with rails. He goes further, and, speaking of general manufactures, says England can no longer expect to get a market for her manufactures in the United States, but she must be prepared to find our manufacturers competing with her in every market to which they have access. Mr. Galton bluntly tells the *Times* that England should appreciate her true position in this matter, and he closes by urging all Englishmen to visit Philadelphia, where they can see the development of American industry, and meet the leading manufacturers as well as the most prominent Americans of all classes.

A NEW OIL CUP.

Mr. Ezra B. High, of Reading, Pa., has patented (July 4, 1876) through the Scientific American Patent Agency a novel improvement in oil cups, which we illustrate herewith. The object is to furnish a constant and uniform supply of oil to the bearing at all times.

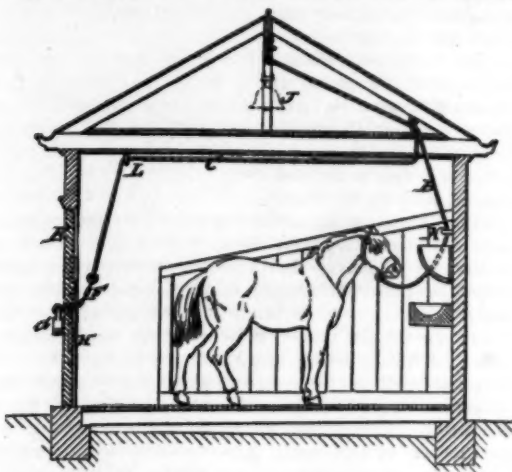
The cup is made in two parts, A D, which are screwed together. The upper part, or reservoir, A, receives a screw plug, G, so fitted as to be airtight. The lower part or distributing chamber, D, is made with a perforated screw stem, to be screwed into the journal or shaft box, and in the upper end of the perforation of which is secured a small tube, E, to receive the siphon wick by which the oil is carried to the journal to be lubricated. In the bottom of the reservoir, A, are secured two tubes, B C. The upper end of the tube, B, rises nearly to the top of the reservoir, A, and its lower end extends down into the distributing chamber, D, so far as to be below the end of the tube, E. The upper end of the tube, C, rises a little above the bottom, a', of the reservoir, A, so that any sediment that may be in the oil will settle upon the bottom of said reservoir, and cannot flow through the tube, C, into the distributing chamber, D. The lower end of the tube, C, may be bent up into such a position that a plug may be inserted in it through the air hole or vent, F, to prevent the oil from flowing down through the tube, C, when the reservoir, A, is being filled. With this construction the oil will flow down through the tube, C, into the distributing chamber, D, until the lower end of the tube, A, is covered, which will prevent the entrance of any more air into the reservoir, A, and will stop the flow of the oil until enough oil has been carried out by the siphon wick to again uncover the lower end of the tube, B, and allow air to again pass up through the tube, B. In this way the oil will be kept at about the same level in the distributing chamber, D, so that the siphon wick may carry it out in a uniform quantity. Air, to supply the place of the distributed oil, enters through the vent, F.



As at present worked, the gold and silver mines of Japan do not appear to be of much value. Iron ore is abundant and the mines are rich. Magnetic ore in sand and lump is most commonly used. Lead is extracted in many provinces, but in a faulty manner and in small quantities. Some of the ores are very rich. Tin is reported to be found in two localities, and the quicksilver mines are not worked.

IMPROVED CONSTRUCTION OF STABLES.

Mr. Frank M. Dixon, of Jefferson City, Mo., has recently invented a contrivance for hitching a horse and fastening a stable door in such a manner that the horse will be freed and the stable door opened in case of fire in the stable, and a contrivance for sounding an alarm at the same time. The engraving shows a transverse section of a stable having the improved appliances. A cord, of cotton or other combusti-



ble material, is stretched along the space above the stable, from side to side, to which the halter of the horse is attached. A cord, C, holds the door, E, shut—say, by a chain, F, and a padlock, G—and the door has a spring, H (dotted line), to throw it open when the cord is released. There is another cord, extending along the space above the stable, from side to side, and connected to an alarm bell, J, and also having the halter and the door cord attached; so that when the cords are burned off by fire, the door will spring open, the horse will be released for escape, and the alarm bell will sound. The halter will pass down from the space above, where it is attached to the cord through guides, K, and the door cord will pass along through suitable guides. The invention was patented on July 18, 1876.

The United States Patent Association.

This society met on September 7, 1876, at the Franklin Institute, Philadelphia, Pa., for the purpose of suggesting means for the improvement of the patent system and the formation of an international association for promoting uniformity of patent laws in all countries. Among the members present were Hon. J. M. Thacher, ex-United States Patent Commissioner; Professor Hedrick, of the United States Patent Office; W. C. Dodge, of Washington, and John S. Perry, of Albany, N. Y., President of the Association.

President Perry called the meeting to order, and read an address, in which he took as subjects of consideration: First, the importance of the patent system in general; and, second, that of the United States in particular, viewed both in respect to the development of original invention and as inciting inventors to persevere in the perfecting of their plans. He showed the benefits which have arisen from the patent system by a review of the condition of Europe before the patent law was recognized. So long as the laws of property were neither recognized nor properly defined, there could be little incentive to invention or the pushing forward of appliances for the better comfort of mankind. Often an individual, like Roger Bacon, would be on the eve of an invention, and often for that matter did invent; but, well knowing that his rights would be unrecognized, he failed to make it public. Indeed it is well known that several inventions and discoveries of great value, which have since been re-invented, were really made, but suffered to die with the inventor or discoverer from this cause. The first trace of patent law is, he thought, to be found in the reigns of Henry III. and Edward IV., of England, in the thirteenth and fifteenth centuries, about which periods the services of the villains or serfs gradually became less onerous and uncertain.

He furthermore said: "Patents are sometimes characterized as monopolies and even as vicious monopolies. With equal reason might the possession of wealth honestly acquired be denounced as a trespass upon the rights of others. To take money unlawfully is called stealing; to appropriate an invention is not by some considered very dishonorable. The public seem to have lost sight of the fact that the inventor has taken nothing which it had before; that he has from his own brain brought into existence and perfected, at his own cost of labor and money, a production as new to the world, and perhaps as useful, as the gold which the miner brings forth from the hidden recesses of the mountains. The most bitter opposition the patent system meets is from the agriculturists, and they of all men are the most benefited by its provisions. With the high cost for labor that has existed during the past twelve years, the business of farming could not have been carried on without the improved machinery that inventors and progressive manufacturers have provided.

"The importance of the patent system in general is shown in that a vast number of articles have been through its instrumentality added to the means of human happiness, of which the latter must otherwise from necessity have been deprived. In reference to the importance of the patent system in the United States, the speaker argued that the history of patent protection is almost coincident with our existence as an independent nation. The law of patents, as it now stands in the United States, rests on the statutes of

February 21, 1783, and April 7, 1800. These statutes have been modified several times, yet our patent law as it now stands is far from being perfect, and it is in the hope of aiding in correcting its errors, and in giving it a wider scope, that the United States Association has been formed."

REMARKS: These views are in the main sound, although tinged with a few misconceptions. Patents, the chairman assumes, are not monopolies, but inherent rights. The poor miner, who controls the gold that his industry brings from the rocks, is just as much of a monopolist, he tells us, as the wealthy patentee, who compels every poor woman to pay him forty dollars royalty, for the privilege of earning her living by means of his patent sewing machine. Such reasoning, Mr. Chairman, will not do. The people know better. They know by actual daily experience that patents are monopolies, some of them of the most oppressive kind; and no sugar-coating by any Patent Association will alter the fact. It is because patents are monopolies of the vicious kind, that they are valuable, and in such great demand. Of what account would a patent be, if the patentee were not clothed with authority over his fellow creatures to enforce his private demands, in respect to his patent? Of none whatever.

According to President Perry, the miner who first discovered gold in the Rocky Mountains was the natural patentee of the entire range, as respects the precious metal. He takes nothing that the public had before; on the other hand, by his discovery, he contributes to the general supply of gold. Therefore, no one but the discoverer, or the favored few whom he permits, ought to be allowed to work at gold mining on the premises. This is poor logic for the United States Patent Association to promulgate.

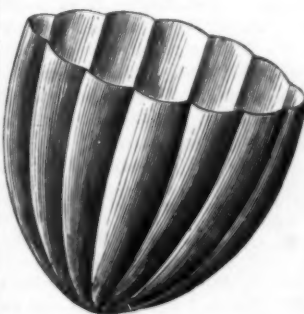
Patents, as we have stated, are pure monopolies. They are only tolerated and granted for reasons of public policy. They are issued solely as rewards: for the mere purpose of stimulating people to discover, invent, and study out new forms of industry. The general weal is promoted by increasing the number and variety of industrial arts, which all the people may freely and equally enjoy. Instead of rewarding the inventor by paying him a sum in cash from the collected taxes in the treasury, the government gives him a patent, or, in other words, makes him his own tax gatherer; and authorizes him to compel the people, by force if necessary, to satisfy his demands.

The redeeming feature of our patent monopoly system is that it effects its object, it brings out new improvements, and is limited to a brief period. Our patents run for seventeen years—a short time in the life of a nation; the inventions then become public property, and everybody may enjoy them, free from the annoying whip and spur of any wealthy private corporation or patent holder. Great as are the inconveniences of our patent system, the benefits are amazing, and greatly exceed the drawbacks. So long as this continues to be the case, the patent laws will stand.

A PAPER EGG CUP.

Here is a new application of that all-useful commodity, paper, to the purposes of table furniture. Mr. R. M. Washburn, of Burlington, Iowa, has patented a paper egg cup, which, besides being a really ingenious idea, is based on sound theory, inasmuch as paper is a non-conductor of heat; it is elastic, so that one cup will hold securely an egg of any size; and it is molded in corrugated form, so that there is always a

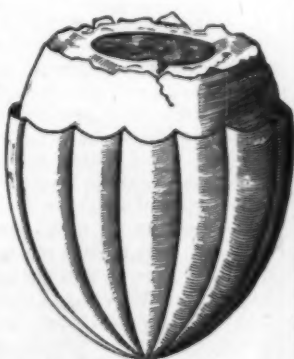
Fig. 1.



circulation of air between the egg and its vessel, which is represented in our engravings as empty in Fig. 1, and holding an egg in Fig. 2. The same cups may be used over and over again, or may be thrown away after each meal, their cheapness allowing of this latter disposition.

They are handy for picnic parties or for persons traveling, and as novelties for hotels, restaurants, and even private houses. The material may be paper, muslin, or almost any fabric. Tinted of different colors, the cups would be quite ornamental; or they might serve as a medium for advertising, so that the person using them may have food for digestion mentally as well as physically. The invention is one likely to be remunerative. It is just such cheap and simple devices which, now-a-days, are most in demand, and produce the largest profit. Those desiring to negotiate for the right to manufacture can obtain further particulars by addressing the inventor as above.

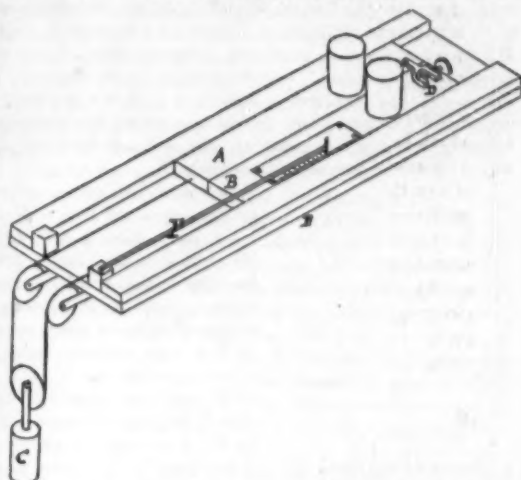
Fig. 2.



A SIMPLE DIVIDING MACHINE.

Among the exhibits of the Massachusetts Institute of Technology, at the Exposition, is a novel instrument devised by the professor of physics, to be used as a dividing machine for graduating scales of equal parts. It can be

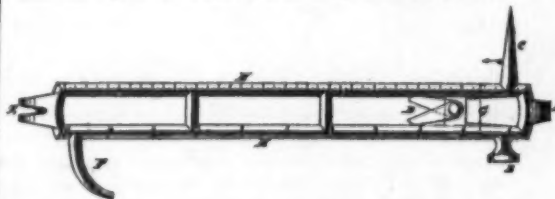
constructed for a trifling outlay by any one who understands the use of tools, and by its aid scales can be laid down with considerable accuracy. It consists of two strips of wood, A, B, which slide in a wooden frame, E. The ends of a cord are fastened to these strips, the cord being fastened, as shown in the engraving, to the weight, C, which is heavy enough to slide the strips along the frame. The strips can, however, be kept in any desired position, by placing weights upon them.



At the upper extremities of the slips is a fork-shaped piece of metal which is secured to the strip, A, by a pin, on which it can turn; and a pin on the strip, B, engages the fork, allowing a certain amount of play, which can be varied at pleasure by the adjusting screw, as shown in the engraving. An arm, F, is attached to the frame by a pin, and has a pencil at the end, this being the marker for constructing the scale on a piece of paper which is fastened to the strip, B. To show the action of the instrument, suppose the adjusting screw is turned so that the play of the fork is $\frac{1}{16}$ of an inch. A piece of paper is secured to the strip, B, and a mark made upon it with the pencil. The weight is then lifted from the strip, B, when it will be slipped along a distance equal to the play of the fork, or $\frac{1}{16}$ of an inch, and a second mark is made with the pencil. Then the weight is replaced on the strip, B, and that on the strip, A, is removed, when B will be slipped along until it is square with A, a stop preventing the fork from turning back any further. The weight is replaced on A, the other removed from B, a third mark made, and so on, alternately moving each strip through the required distance, until a sufficient number of divisions is obtained. R. H. B.

NEW COMBINATION TOOL.

Mr. Lester Beach, of Derby, Conn., is the inventor of a novel and ingenious combination tool, an engraving of which is presented herewith. The body of the tool consists of two parallel bars, connected at their ends, and at suitable distances apart between said ends by crossbars, so as to



make the tool light and at the same time strong. Upon one end of the tool is formed a screwdriver, A, near which is a hammer head, B; and upon the other edge is an ice pick, C. To one of the crossbars are attached two small steel plates, D, arranged at an angle, so that they may be used as a knife sharpener. Upon the other end of the tool is formed a notched claw, E, for pulling tacks and for lifting stove covers. Upon the edge, diagonally opposite the ice pick, C, is formed a curved finger, F, which may be used as a poker and as a pot lifter. At one end the space, G, is made slightly tapering, and the inner edges of the side bars are flattened, to adapt said space to be used as a wrench for turning various sized nuts. Upon the side bars of the tool are formed division marks of inches and parts of an inch, to adapt the tool to be used as a rule, H. Patented through the Scientific American Patent Agency, August 1, 1876.

The East River Bridge.

Chief Engineer Roebling now intends to hoist a carrier rope of 1½ inches diameter, instead of 1¼ inches, as originally intended, between the towers of the East river bridge. The increased weight will prevent the carrier rope from being hauled across by the traveler ropes now in place; and it will have to be carried across the river in a scow and hauled taut between the towers, as was done in the case of the first traveler rope. Two 1½ inches carrier ropes will be placed in position; and then the cradle and foot bridge ropes will be hung on them by pulleys. The carrier ropes are of chrome steel wire, and will weigh about 22,000 lbs.

A Statue of Lafayette.

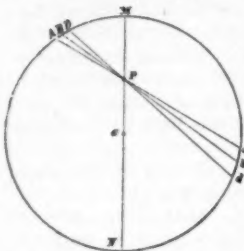
The French republic has recently sent, as a gift to the citizens of New York, a bronze statue of Lafayette, the renowned soldier whose zeal in the cause of republicanism brought him to this country 99 years ago, and enlisted him in the army which achieved our independence. The statue has been erected in Union Square, looking down Broadway; and it was unveiled on September 6, with appropriate ceremonies.

Correspondence.

The Weight of a Body Inside a Hollow Sphere.

To the Editor of the Scientific American:

I am surprised at the half knowledge shown by your correspondents in their discussion of the attraction of a hollow sphere on a body within it. Can any one name a scientific man of repute who has repudiated it, or the demonstration of it, which is to be found in "Newton's Principia"? If Mr. Whitmore chooses to represent the mass which exerts the attraction on the body, P (see the illustration on page 84), by the cup-shaped fragment, B E F G C B, his position is undoubtedly correct; but the calculation of the attraction becomes so troublesome that we may well ask for a simpler way. Newton's theorem furnishes this.



In a thin shell, whose section is the circle at A M u N A, let a body, P, be found; draw through P in any direction the line, B P b, and revolve around it the line, A P a, which makes with it the small angle, A P B: the resulting circles, shown in section at A D, a d, will have the areas $\pi(A B)^2$, $\pi(d b)^2$, and the masses $= \pi m t (A B)^2$, $\pi m t (d b)^2$, where t = the thickness of the shell, and m = the quantity of matter in the unit of volume: the attractions on P will equal these masses divided by the squares of the distances from P, namely, P B, P b, and multiplied by a constant, f , thus: Attraction

at B: attraction at b :: $\frac{2\pi m t f (A B)^3}{(P B)^3} : \frac{2\pi m t f (d b)^3}{(P b)^3} :: (A B)^3 (d b)^3 : (P B)^3 (P b)^3$. But from the similarity of the very acute

angled triangles, A B P, d b P, we have A B : B P :: d b : P b. $\therefore \frac{(A B)^3}{(P B)^3} = \frac{(d b)^3}{(P b)^3}$, and therefore attraction at B = attraction

at b. That is, the body, P, will not move in either direction along the line, B P p; and as this line may be drawn in any direction whatever in the shell, the body at P will not move in any direction, and will therefore be in equilibrium at every point. To prove this for thick shells or hollow spheres, it is only necessary to conceive them as made up of an indefinite number of thin ones.

Professor Olmsted has been placed in apparent contradiction with this truth because it was forgotten by the writers who quoted from him that the attraction of gravitation varies inversely as the square of the distance. Thus, if the body be lowered half way to the center, it would be attracted by a mass equivalent to one eighth of the original sphere; but as the distance between the body and the center of the sphere is only one half of what it was before,

the attraction will equal $\frac{1}{8} \div \frac{1}{4} = \frac{1}{2}$; or in general, if the

force at the surface of a sphere, of radius r , be represented by 1, and the portion lost in descending a distance, d , by x ,

we have: $1 : 1 - x :: \frac{r^3}{r^3} : \frac{(r-d)^3}{r^3}$; $\therefore 1 : 1 - x :: r : r - d$.

$\therefore 1 - x = \frac{d}{r}$ or $x = \frac{d}{r}$; that is, a body lowered toward the

center of the earth would lose in weight and proportion to its distance downward, as Olmsted says.

Your correspondent further confounds attraction with weight when he says: "Guided by this theorem, we should expect a hollow sphere to balance if suspended from any possible point within the void." Not at all. The confusion comes from not distinguishing between the attraction between the earth and the portions of the shell on opposite sides of the point of support, and the almost infinitesimal attraction between these portions and any body at this point.

The theorem is in fact not to be proven experimentally, but is an inevitable consequence of the grand, often verified, never disproved law that every body attracts every other with a force directly as the product of its mass, and inversely as the square of the distance between them, that is, $f = \frac{m m'}{d^2}$.

It should perhaps be added that the demonstration above given, as Newton himself pointed out, is only true when each shell is homogeneous, though neighboring shells may vary in density to any extent. In the case of the earth, the curious result is found that the center of the earth is so much denser than the part near the surface that the force of attraction increases at first on descending; and so Professor Airy's clock, in the mine 1,250 feet deep, gained 274 seconds daily.

C. K. W.

South American Birds.

To the Editor of the Scientific American:

On the eastern shore of the Uruguay river, from Paysandu to Independencia, there is an open rolling country with frequent small ravines, most of which are bordered with a narrow skirt of timber of stunted growth and flowering shrubbery, which makes a fine retreat for the birds, and also frequently shelters the deer, South American tiger, and wild cat, which, however, are not abundant. The hill tops are also crowned with timber of similar growth, making a pleasant shade and resort from the scorching sun. Except on the hill tops and in the ravines, the country is partially covered with tall coarse grass, which makes a fine

cover for quail and partridge. On approaching a ravine, the first thing that attracts your attention is the hum of the humming birds, which are of numerous different varieties, each bird balancing nicely on its wings while it inserts its long slender bill and extracts sustenance from the desert flower. Along the ravines, wild pigeons, similar to ours, are to be found in plenty, and are easily bagged. Next is the small partridge, very much like our northern quail, which are difficult to bag on foot and without a dog, as they will hide in the tall grass; but with a trained dog, the sport is fine. On horseback, you may almost ride over them before they will fly up. They are in flocks generally, yet they do not huddle; and it is difficult to get more than one at a shot. But you may sit on your horse and shoot a whole flock singly, as they seldom fly except they are flushed by a dog. The large partridges, which closely resemble English pheasants, are generally found singly, and the mode of catching these birds is rather peculiar.

They are found amongst the tall grass. The sportsman is mounted (carrying no gun, however) and has his dog trained to the work. He walks his horse slowly along, while the dog hunts about amongst the grass; and when he comes close upon the bird, the latter breaks cover, rises a little above the grass, and flies off on a level. When the bird flies, the sportsman puts his horse to his mettle and follows to the spot where he sees the bird alight (probably a hundred yards), and waits the arrival of the dog, who follows at his top speed and rushes in amongst the grass; and soon again the bird breaks cover and flies as before, but only about half as far. The sportsman and dog follow up as before, and the bird is hunted out again by the dog, and divides the distance again, and drops into the grass, pursued by sportsman and dog, this time closing the race for life. The dog rushes into the grass and directly comes out again with the bird unharmed in his mouth; the sportsman in the meantime dismounts and receives the bird, and disposes of him as he thinks proper. I was once an eye witness of such a race, and was told that these birds never break cover but three times, which seems to me rather strange.

Stratford, Conn.

TRUMAN HOTCHKISS.

The Atmosphere of the Moon.

To the Editor of the Scientific American:

The moon is considered, by some astronomers, to have no atmosphere, as you mentioned in a recent issue; and in the article you gave some very plausible reasons for supposing that there may be an atmosphere of some kind on that body.

Heat, as you say, would have a great influence in expanding the air to a great extent, and rendering it so rare that it would extend out from the surface of the moon a great distance, so that its presence could hardly be detected by us. Yet when the moon cooled, the air would be condensed, and then be as dense or denser than our atmosphere, and could be easily detected.

To prove that the detection of the presence of the atmosphere would be difficult when the air was rare, and comparatively easy when the same bulk of air is made to occupy a smaller space, is very simple; for if we take a cubic foot of air or any other gas of the density of our atmosphere, the refraction of a ray of light passing through it would be very evident; but, if the same amount be made to occupy one hundred cubic feet, the refraction would be very much more difficult to detect, for, according to the old rule, "the greater the difference of the densities of the two gases, the greater the refraction, and vice versa."

Covington, Ky.

WILLIAM L. DUDLEY.

The Direct Motion of the Radiometer an Effect of Electricity.

To the Editor of the Scientific American:

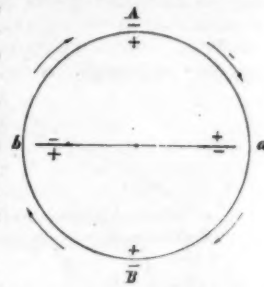
In the communication I sent you a few days ago, upon the radiometer of Professor Crookes, I showed that the exterior of the glass globe was electrified negatively when exposed to luminous or calorific radiations. Having made, since that time, some more experiments, I have discovered new facts which enable me to explain at least some of the motions of this wonderful instrument. The facts are as follows:

I took a strip of mica two diameters (7.8 inches) in length; and having coated one of the sides with lampblack, when it was quite dry I suspended it in a Coulomb's torsion balance, having previously electrified the metallic disk of the balance needle with positive electricity. The blackened side of the mica faced the electrified disk. When the needle had come to rest I allowed the radiations from a large gas flame to fall upon the blackened surface of the mica. Notwithstanding the light was at a considerable distance and had to penetrate the thick glass shade enclosing the balance, the needle was rapidly repelled several degrees, showing that the blackened face was positively electrified under the influence of radiation. I then turned the strip of mica so that the bright side faced the disk and allowed the radiation to fall as before, upon the blackened surface. This time the needle indicated an attraction between the disk and the mica, thus proving that the bright surface was negatively electrified.

To anticipate an objection to the theory of the radiometer which will be suggested by these facts, namely, that these electrical manifestations are too feeble to account for the rapid revolution of the arms, I made the following experiment: I rubbed the globe gently with a brush composed of fine threads of glass; the electricity developed on the globe, acting by induction upon the nearest mica disk, caused a brisk oscillation. I then measured the intensity of the electricity upon the glass globe by means of the proof plan and Böhnenberger's electroscope. There was no indication of

greater intensity in this case than there was when the globe was electrified by the radiations from aluminous or obscure source and tested in the same manner.

From the above facts the following theory necessarily flows as a corollary; The hemisphere, A, being negatively electrified, as we have shown, upon its whole exterior surface, we justly conclude that the interior is positively electrified. The hemisphere, B, is electrified in the same way, but its intensity is different, the charge being less at B than at A.



The mica disk in the position, a, with its blackened side turned towards the radiant source, is electrified positively upon the black and negatively upon the bright surface, as we have proved above. As like electricities repel and unlike attract, the positive electricity at A will repel the arm, and that at B, acting upon the bright face, will attract it, so that it will necessarily rotate in the direction of the arrows, namely, A a B. When the arm has reached b, the direction of the rotation will not be changed, but A will now attract, and B repel, and it will continue to move in the direction B b A. The direct and most usual movement of the arms in Professor Crookes' radiometer is thus explained in the simplest manner.

JOSEPH DELSAUX, S. J.

11 Rue des Recollets, Louvain, Belgium.

[For the Scientific American.]

NOTES ON THE RESISTANCE OF MATERIALS.

The ordinary formulæ and tables in technical works for proportioning the parts of machines and structures are based on the ultimate resistance of the material which is to be employed, accompanied by recommendations that a certain fraction only of the breaking load should be applied in practice. This fraction varies from $\frac{1}{4}$ to $\frac{1}{3}$, according to the views of different authorities. It has been found, however, that a material may be strained in such a manner as to become unsafe, by a load that is generally less than half the ultimate resistance, so that some of the best authorities consider that the fraction of the breaking load, or factor of safety, should be chosen with reference to the elastic limit of the material rather than its ultimate resistance. Still more recently, attention has been directed to experiments showing that materials could be ruptured by the repeated application of a comparatively small load. It is obvious that a rule for proportioning a machine, which provides for safety by using only a part of the strain allowed by the theory in which the rule is founded, is at best only a makeshift, and is unsatisfactory on many accounts. If the structures of the materials used in the arts were understood, so that the effect of strains could be accurately noted, it would of course be easy to give rules which would enable the material to be disposed in the most effective and economical manner. The experiments on the effect of repeated strains, referred to above, furnish some facts on which a novel and interesting theory of molecular structure has been based. Although this theory is far from being fully verified by experiment, it is, to say the least, not absolutely contradicted. A good discussion of the subject has recently been given by Professor Spangenberg of Germany, and a translation of the same has been published in this country, from which the following account has been condensed.

What is commonly regarded as a solid is supposed, in the theory referred to, to be made up of a number of atoms and molecules, surrounded by ethereal atmospheres, and grouped in various forms, according to the temperature and nature of external strains. Most readers know that the theory, so far, is in accordance with that generally adopted by scientists. Perhaps it never can be absolutely proved, although it has been shown to be extremely probable. Now it is known that when a mass of metal is melted and poured into a mold where it is rapidly cooled, it tends to crystallize in groups, and this is regarded as the first normal condition. Wrought iron and steel are generally rolled or hammered before use, and this breaks up the crystalline groups and produces a fibrous grain. When a metal is subject to strain, the grouping of the atoms will be changed, and they may return to their former position when the load is removed, or may take new forms, according to the amount of the strain and the rapidity of its recurrence. The effect of repeated strains is to break up the crystalline structure, and induce an amorphous condition. In changing to this state, the strain may act so quickly that all the crystals are not affected, and rupture will occur. The atoms of the body are supposed to have a mutual attraction for each other, and the other atoms attract those of the body and mutually repel each other.

It seems to be settled by experiment as well as theory that, contrary to general notions, the resistance to rupture of a body is less, the more crystalline is its structure, and increases as the amorphous structure is produced. It is supposed that the cohesion between separate crystalline groups is less than the cohesion of molecules forming a crystal.

The experiments given in connection with this theory show conclusively that the number and duration of strains are of quite as much importance as their magnitude. Whether then, the theory on which this action is explained is accepted or not, the facts seem to show the point to which future experiments on the strength of materials should be directed. Possibly the United States testing board may derive some hints from Professor Spangenberg's treatise.

R. H. B.

CHEMICALS AT THE CENTENNIAL.

THE FRENCH EXHIBIT.

The number of exhibitors is about the same as in the German department, but the exhibits taken together are less interesting, we think, than those of Germany. The want of a good French catalogue of their chemicals is severely felt. Beginning with the aniline colors, those of A. Poirrier, Paris, are particularly noticeable, both for quantity and color. One huge mass of *violet de Paris* (dimethylaniline violet) is over 2 feet long and 18 inches wide. Several of the aniline dyes are exhibited in glass fruit dishes, the foot of each dish being wrapped with silk dyed therewith, and exhibiting a striking manner the difference of color which these dyes have when dry or in solution, as most of the reds and violets form green crystals. This seems due to the fact, equally difficult of explanation, that they reflect one color and transmit another, wherefore solution and films are red, thick masses and crystals green or bronze. In addition to several aniline colors, so called, this firm exhibits the new and costly eosine in larger quantity than almost any one else. Also specimens of benzyl chloride and benzoic acid made from the latter, as well as benzyl anilin. This exhibit is unequalled except in the German department, where Bayer & Co. and the Berlin Joint Stock Company compete for the first place. Some large blocks of corallin, anilin red, etc., are exhibited by Guinon's Sons & Co., Lyons, as also orzulin, cochineal, picric acid, and bisulphite of soda. Clauseau exhibits madder root, whole, in powder, and flour, alizarine and purpurine from madder, alcohol from madder, and madder extracts. A. Beslier exhibits the whole plant of *thapsia garganica*. Several parties exhibit dyes woods and extracts used in dyeing. Charles Dubois exhibits a number of cyanides and other poisonous salts for use in the navy, probably as wood preservers, including cyanides of lead and copper, sulphocyanides of mercury, copper, and arsenic, chromate and arsenite of mercury, etc.

Solvay & Co. exhibit both here and in the Belgian section a set of substances to illustrate their new ammonia soda process, namely, salt water, crude ammonia liquor, carbonate and bicarbonate of soda. The analyses show the extraordinary purity of the soda obtained in this process. The carbonate of soda contains 99.438 per cent of the pure salt, (Na_2CO_3), 0.21 of common salt (NaCl), 0.0015 of sesquioxide of iron. The bicarbonate is, of course, less pure, containing bicarbonate of ammonia to the amount of 0.42 per cent, which is expelled along with the extra equivalent of carbonic acid, on heating to form the monocarbonate. Photographs of the exterior of the works are shown.

The most interesting pharmaceutical exhibit is that of C. Torchon, Paris, containing a huge block of chloral hydrate, ditto in crystals, a whole guinea pig preserved by the injection of chloral, specimens of hydrosulphide of chloral, metachloral, and alcoholate of chloral. In the same case is a bottle of petroleum said to have been produced synthetically, by the action of carbonic acid and steam on sulphide of iron.

There are, indeed, many soap and candle exhibits, a few carbolic acid exhibits, sulphur in several forms, capsules and pills, insect powder, glue, gelatin, and bone black; but little of real interest to the chemist. Of ultramarine we noticed but two exhibits, those of F. Richter, of Lille, and Guimet, of Lyons. Faure and Kessler's pan apparatus for concentrating sulphuric acid is also to be seen in this section.

THE BELGIAN EXHIBIT.

One of the most interesting objects in the Belgian section is a working drawing (elevation) about 6 feet long, illustrating A. De Hemptinne's new method of making and concentrating sulphuric acid. We think this process has not been tried on a manufacturing scale, but it is attracting more attention at this moment, among practical men, than any other novelty in this important industry. Solvay & Co., Couillet, near Charleroi, have a better exhibit of the ammonia soda process here than in the French section above referred to. The other exhibits are unimportant, excepting the coal tar colors of Max Singer.

THE SWISS EXHIBIT.

Bindschedler & Busch, of Basle, deserve notice for their coal tar products, which include some remarkably large needles of crystallized anhydrous phthalic acid, diphenylamine, artificial alizarine, crystals of anthraquinone, resorcin, toluidine, eosine, and ether of tetrabrom-fluorescene, which latter is the correct scientific designation of the beautiful eosine already mentioned. A manufacturer of coffee substitutes, fig coffee, vanilla coffee, etc., makes quite a display here, as does Hurlimann, who shows artificial Swiss honey. We also noticed several specimens of phosphorus bronze, which are interesting, although not strictly chemical.

HOLLAND.

The Netherlands are poorly represented in this department; even coal tar colors are absent, and soaps, oils, glass, inks, and paints, with one large pyramid of crude sulphate of ammonia, exhaust the list. One case contains a fair show of minerals, including a large mass of malachite, and smaller pieces of amethyst, *lapis lazuli*, and labradorite (locality not given). Von Ketten exhibits a powerful horse-shoe magnet, composed of seven leaves; it is 2½ feet long, weighs 83 lbs., and will lift, he says, 500 lbs. A series of models illustrating in detail the effects of the cattle plague were of particular interest, as showing the care with which this subject has been studied abroad.

SWEDEN.

The land of Berzelius is largely given up to "match-making," if we may judge from the catalogue, where no less than 16 out of the 37 exhibitors deal wholly in safety matches. Norway sends over but five match makers. The well known safety match of the Jönköping's Company occupies a beautiful case, where we find matches, pocket match safes, igniting surfaces, and a new double safety match, which it is said ignites only on the box, and becomes entirely dead instantly the flame is extinguished. In the neighborhood of this famous case are columns covered with matches, with candles, and with assepline, for the preservation of provisions and animal material. Bengston exhibits some soda and Glauber salts, and Werner some bone oil, in little flasks tastefully suspended to circular rings in tree form. Kimtze & Co. exhibit several water filters, and Almén a variety of medicated gelatin. The celebrated Swedish filter paper, the only paper used in quantitative chemical analysis, is exhibited by the Grycksbo Factory at Falun. The same firm exhibit writing, drawing, and printing paper, with a copy of Berzelius' commendatory notice of their filter paper. We saw no filter paper elsewhere in the exhibition, but we believe that Germany is now in close competition with Sweden in that line.

AUSTRIA.

We were disappointed to find that Austria had not thought it worth her while to send over anything but soap and candles. Ozokerite, or mineral wax, seems to be the staple production of certain parts of Austria, Gallicia more especially, and all the changes are rung on this one substance to the exclusion of more interesting products. F. A. Sarg, Son, & Co., Liesing, near Vienna, have a large white tablet, nearly 20 feet long and perhaps 12 feet high, made of blocks of stearine with a yellow border of wax, and their name and place of business in large letters upon it. This firm exhibits oleomargarin, milky candles, and candles of paraffin and ozokerite, an interesting collection of fatty acids both solid and liquid, glycerin, wax, etc. Another handsome display is that of H. Ujhely & Co., Stockerau, fancy wax in great variety. G. Wagemann exhibits refined mineral wax and petroleum; and Paul Dobel, Boryslaw, Gallicia, exhibits the crude ozokerite in its natural state as well as the melted and refined article.

More of a truly chemical nature is the exhibit of anthracene, alizarine, sulphanthraquinone, and its sodium salt, by Pzibram & Co., Vienna.

The royal-imperial director of the Idrian mines sends a set of minerals and products such as cinnabar, uranate of sodium, potassium, and ammonia, oxide of uranium, and the like.

Chemical glassware of the latest and best forms is sent by Lenoir & Forster. Small sets of chemical and physical apparatus for national schools comes from A. Kreidl, Prague. The entire collection consists of 76 different articles and reagents, and costs, including packing, 53 Austrian florins (about \$26) in Prague. This complete set, as the circular calls it, seemed to us quite incomplete, and, like most little sets of this kind, almost useless either for the instructor or learner. The general display of Bohemian glass ware, of course, is extremely elegant; but a description of it would out of place here.

In an out-of-the-way corner is a small horizontal case, occupying scarcely two square feet of space, and seldom noticed by the visitors, containing a new kind of confectionery, exhibited by Josef Gobetzky, Esseg. It differs from most articles of this nature in that it contains a tasteless salt of quinine, said to be the tannate. It is probably the same as those made by Rozsnyay, in Arad, and described and endorsed by Dr. H. Hager in his *Pharmaceutisches Centralhalle*. The latter analyzed them and found that each lozenge contained 0.97 grain of hydrate of quinine in the form of tannate. The chocolate pastilles contain about 0.93 grain of hydrate of quinine. If they are really all that is claimed for them, tasteless and yet therapeutic, we hope to see them introduced here.

ENGLAND.

Like those of the Austrian section, the English chemicals deserve but brief notice. Soda ash is the staple, and all the possible changes are rung on it, nor are we surprised at this, for this is England's leading industry. Some firms send over chloride of calcium, sulphur, and starch; one firm sends a bust of Lincolnton made of ozokerite. The Price Candle Company exhibit a large number of photographs of the fatty acids, showing the effect of admixture with varying quantities of other acids or of paraffin. Dr. Siemens exhibits a model of his regenerative gas furnace. Some beautiful iridescent crystals of chlorate of potash are shown by the Greenbank Alkali Company. The finest display of rarer chemicals is that of T. & H. Smith, which, like many others, are not down in the official catalogue. They exhibit a large cake of caffeine, and smaller quantities of codeia, cryptopia, apomorphia, muriate of thebaia, citrate of caffeine, other rare alkaloids, and theobalactic acid, an acid discovered by Messrs. Smith and obtained by them from the mother liquors of morphine. It is possible that it is really nothing but ordinary lactic acid.

Importance of Well Seasoned Timber for Carriage Building.

Lumber for bodies and gearings, including ash and poplar for the former, and hickory for the latter, to be properly seasoned should be nicely piled in the shade, and protected from exposure to wet weather. The cross slats between the boards should not exceed four feet in distance apart, so as to prevent the boards from warping out of their original shape.

Boards, as a general thing, check in at the ends, very often several inches, and sometimes a foot or more, and, of course, the lumber at that part is thereby rendered unfit for use. But to prevent this being a serious difficulty, it is simply necessary to place the end slats as close to the edge of the end as possible. Now, it is very obvious that moisture will be retained at the slats more than on the naked parts of boards; the result is that the boards do not shrink so rapidly at the slats as they do away from them; and consequently the boards remain whole and do not become wavy.

It is said by those who profess to know something about wood that, if you set timber upon one end, it will season quicker than it will if laid down. That is very likely so, and if so it may be caused by the fact that the sap or matter ejected ascends through the pores of wood set upon one end, without any hindrance, while it could not so readily if laid down. It is seen that fibers of the wood are longitudinal connections, and all the substance to be ejected collects between these connections in the pores, running from one end of the wood to the other, and flows out in the same direction. That is why the transverse expansion or swelling of wood is great, while its increase in length is hardly perceptible, when the pores absorb water.

Bodies, to be durable, should have the stuff in them highly seasoned, but not have it cooked too much by suspending it over a stove, so as to deprive it of the requisite substance and render it brittle. Cooking panels, as just described, brings them in such a condition that it is impossible almost to get them solidly glued on the frame without checking them at the ends, and at the same time they are liable to be split in two.

All that panels require after they are thoroughly seasoned, after fastening them to the frame, is to take out the dampness by warming them; and the frame does not need anything more. But proper seasoning is a requisite.

No matter how well developed constructiveness may be in a body maker, or the other faculties that aid him, or how experienced a mechanic he may be, even if he can make bodies without any person being able to discover the trace of a joint, if the stuff is not seasoned before it is put together, the body will not, cannot, stand.—J. W. Daron, in the *Hub*.

THE AMERICAN SOCIAL SCIENCE ASSOCIATION.

A largely attended meeting of this body took place at Saratoga, N. Y., during the week ending September 9, and many papers of value and importance were read. Among the most prominent was one by Mr. Edward Atkinson, of Boston, Mass., on

THE RELATION OF CAPITAL TO ANNUAL PRODUCTION AND SUBSISTENCE.

He commented on the outcry for cheaper transportation by stating that 500 lbs. of meat and grain constitute the full subsistence of an adult man for one year, and it cost to-day but \$1.25 to move a quarter of a ton or 500 lbs. from Chicago to Boston, less than one day's wages of a good mechanic. In this low cost it would be difficult to find evidence of the rapacity of the railway monopolists. So far as the people of Massachusetts eat bakers' bread, it costs them more to move the bread from the bakers' oven to the mouth of the consumer than it does to move the flour from the wheat field to the oven. There are, doubtless, grave defects in our railway system, but the fact must not be ignored that those special corporations, against which the most urgent charges of monopoly have been made, are the ones that do the most service in distributing the largest quantity of product at the least relative cost to the community.

The remainder of Mr. Atkinson's paper, which was too long for publication in *extenso*, was chiefly devoted to the capital and labor question; and it closed with a vigorous attack on the greenback form of money.

Mr. H. R. Hayden read a paper on

LIFE INSURANCE AS A SOCIAL FORCE,

in which he pointed out that a sound system of insurance effects a distribution of the loss which afflicts relatives when premature death occurs, and which averages human life as far as the well-being of the survivors is concerned. He complained of the laws affecting insurance in many of the States, stating that they gave advantages to the dishonest and so destroyed public confidence.

Mr. Nordhoff read a paper on

THE INDUSTRIAL AND SOCIAL CONDITION OF THE SOUTH, a question which can hardly just now be kept clear of politics; and Mr. Nordhoff's essay dealt chiefly with the subject as it shows the difference between republican and democratic misgovernment.

Professor Dwight read a paper on

LEGAL EDUCATION IN THE UNITED STATES,

in which he contrasted the position of the lawyer in this country with his *status* in England. In the latter country, the lawyer confines himself to one branch of the profession, and obtains an accurate though limited knowledge; but here the lawyer prepares himself in each department of professional labor, and obtains breadth and comprehensiveness at the cost of precision and accuracy. He furthermore advocated reforms in the system of college examinations, and an increase in the opportunities for students to acquire sound learning and a high sense of professional honor.

CLEANING BRASS INLAID WORK.—Mix tripoli and linseed oil, and dip felt into the preparation. With this polish. If the wood be rosewood or ebony, polish it with finely powdered elder ashes, or make a polishing paste of rottenstone, a pinch of starch, sweet oil, and oxalic acid, mixed with water.

A NEW STEAM ENGINE.

Messrs. Eli James Smith and Benajah Mason, Jr., of North English, Iowa, are the inventors of the novel steam engine herewith illustrated, which was patented through the Scientific American Patent Agency, August 1, 1876. The cylinder consists of two flanged sections, which are bolted to a central partition, C. A valve, *a*, is placed in a slot cut in the head, C, and is pivoted at *b*. D D are pistons, which are placed upon a piston rod, E, the distance between them being a little more than the length of the stroke and the thickness of the central head combined. The valve, *a*, is enlarged above the pivot, *b*, so as to engage with the bosses on the pistons, D D, at the end of every stroke, being moved by each piston in alternation, opening the supply passage, *c*, and the exhaust passage, *d*. The lower end of the valve is continued outside of the cylinder, and formed into a handle at *e*. The cylinder, A, is mounted on suitable supports, and the piston rod, E, is connected with a crank and fly wheel in the ordinary way.

Steam is taken through a pipe, F, and through the open port, forcing the piston away from the central head, the piston remote from the head following, of course, until it strikes the enlarged portion of the valve, throwing the valve over, and allowing the steam to enter on the other side of the central head, forcing the piston toward the end of its stroke. At the same time the lower part of the valve opens the exhaust port, allowing the steam to escape through the passage, *d*. If it is desired to reverse the engine, it is only necessary to move the valve, by means of the handle, *e*, at the proper instant, when steam will be admitted on what was before the exhaust side of the central head. When the engine is made vertical the upper section of the cylinder is made a little larger than the lower one, to compensate for the weight of the pistons.

THE ORIGINAL STEAM STEERING APPARATUS.

It is very rarely that any invention survives a period of half a dozen years without being made the subject of so many improvements and modifications that, in the end, it often happens that little or none of the original device remains. We know of no exception to this rule more remarkable than that of the steam steering apparatus in which steam, for the first time, was used to operate the rudder of a vessel. This machine, in its present form, is practically identical in operation with the first tangible outcome of the inventor's thought. The lapse of 25 years has worked no notable change in its mechanism; and the first apparatus of the kind ever built—an engraving of which as it appears at the Centennial Exposition is given herewith—compares in every way favorably with those of most recent construction, despite the fact that the latter embody mechanical refinements not found in the early model.

The inventor of this device, the importance of which is now recognized the world over, is Mr. Frederick E. Sickels, already one of the most famous of American inventors through his origination of the well known Sickels cut-off. The control of the rudder is secured by operating the valves for the admission of steam to the cylinders by a hand wheel. The rudder is thus compelled to follow the motion of said wheel, which is similar in form and mode of operation to the ordinary helm. Suitable disconnecting and connecting gear is provided, whereby the steam apparatus can be thrown out of action and the helm worked by hand in the usual way.

Apart from its serving as evidence of the non-alteration of the device from its original form, the apparatus at the Exposition is obviously possessed of much historical interest. It was used by negro pilots in the South previous to the war without the slightest failure in its operation; then it was exhibited in the Crystal Palace, in this city, in 1853-4. It was next put aboard the steamer *Augusta*, running between Savannah and Fernandina, on a route extremely difficult of navigation by single engine steamers on account of crooked channels. It was, when thus located, submitted to the severe tests of heavy gales and rough seas, without any impairment of its efficiency taking place. When the war broke out, the *Augusta* was brought to New York, and the machine was removed and sent to the London International Exhibition of 1863. There it attracted great attention, and a medal was awarded it; and from this time the machine, of which it is the prototype, has gradually been creeping into use.

A model which is exhibited at the Centennial beside the large machine, Mr. Sickels states, is prior in date to any attempt, in books, drawings, or models, to devise a power-steering apparatus. It appears further that Mr.

Sickels first began experimenting upon the subject as early as 1847.

During the present year the invention has been tested by a board of naval officers, and its adoption in the United States naval service strongly recommended. It has already been adopted in the English navy, and is employed on nearly all the British merchant steamers which enter the port of New York. From the owners of these last the inventor receives no royalty, nor do the former in anywise make return for the benefits they enjoy, preferring to avoid

of the time devoted to the examination of the Centennial Exposition, than in making just such studies as this. There are other original machines—notably a model of the first sewing machine made by Saint in the last century, beside Elias Howe's original device—which would form profitable subjects for further examination of the same nature.

A Plea for Inventors.

Of all the mental efforts requiring imaginative construction, none is more difficult than that which is required to develop a new mechanical movement, or originate a new plan-mode or mechanical principle. The faculty of inventing depends more upon natural endowments, or rather instinctive intelligence, than upon education and experience. Experience only serves to familiarize the inventor with the wants or deficiencies in any particular line of industry, and education assists in giving completeness to the conception; but the conception itself is a matter entirely independent of either, and is just as apt to be suggested by an illiterate and inexperienced person as by one who has spent years in studying and investigating the matter: in fact more so, because education and experience are both the results of study and long familiarity with existing devices, so that they, to a certain extent, incapacitate their possessors from looking beyond the boundary of their experience and teaching. Upon the principle that "fools rush in where angels fear to tread," the illiterate inventor will investigate methods and plans which many an experienced artisan or workman would not entertain for a moment, simply because they do not possess that imaginative construction necessary to give the

new creation mental existence, and because their teaching and experience do not include the new idea. Thus many of our most important and most novel inventions have been originated and developed by persons entirely devoid of technical knowledge and experience in the field of mechanics to which their inventions belong. Accident, circumstance, and necessity all contribute to the discovery of new principles. Sometimes, however, we find the skilled and educated mechanic possessed of the inventive faculty, and when this is the case he proves a "world mover." Such was Ericsson, who did more to develop the engine and strengthen the navies of the world than all other inventors combined. Such was Morse, who, with a skill and learning which was admirable in its completeness, adapted and perfected the telegraphic system with such precision and judgment that to-day it retains the principal features that he gave it. Such were Hoe and Colt, and other inventors whose memories the civilized world hold in reverence.

All patents are not productive, neither are all farms; all men are not rich; all mines are not bonanzas; but if we were to strike a balance sheet we would find that the proportion of the profitable and unprofitable patents correspond in a like ratio with the other profitable and unprofitable enterprises which men undertake.

When we consider the vast number of patented articles in the market, many of which are covered by a number of patents, we will realize that the work of the inventor is very often profitable. There is scarcely an article of human convenience or necessity in the market today, that has not at sometime or other been the subject of a patent, either in whole or in part. The sale of every such article yields the inventor a profit. If we purchase a box of paper collars, a portion of the price goes to the inventor; if we buy a sewing machine, the chances are that we pay a royalty to as many as a dozen or fifteen inventors at once. Indeed the field is so vast and the number of profitable patents so great that it would be far preferable to undertake a recapitulation of those patents which are not profitable than those which are.

The universal sentiment is that genius is its own reward; and in order to give effectiveness to the sentiment, the person who possesses genius in any branch of industry is allowed to set his own price upon the result of his labors. It is therefore but a just recognition of the services of the inventor that he be allowed to provide for his own wants from the benefits which he confers upon the public. The artist who produces a picture of unusual merit can find purchasers for it at a fabulous price. The stage actor who can draw crowded houses can demand and receive for a single performance what would be a year's salary for an ordinary workman; and the lawyer that possesses the faculty of swaying the minds of a jury by his eloquence can demand and receive whatever sum of money he desires for his services; yet the labors of the inventor yield more substantial results, and benefit mankind more than all these combined. He is the sapper and miner who prepares

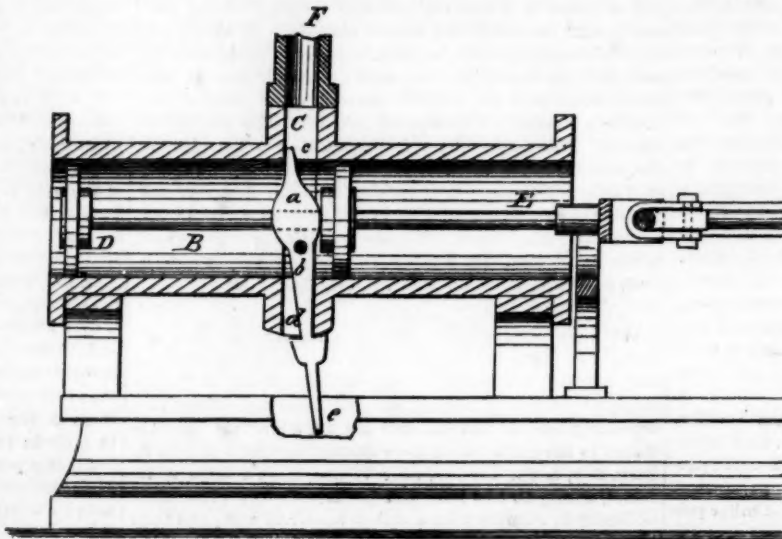
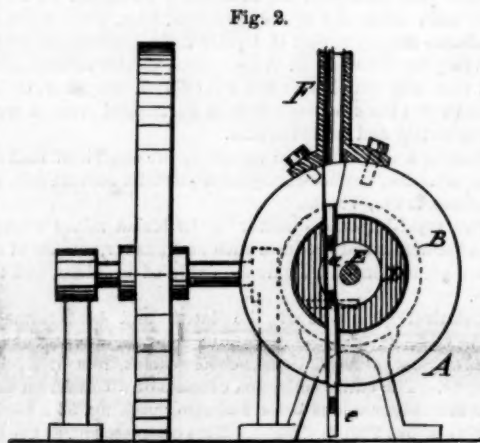
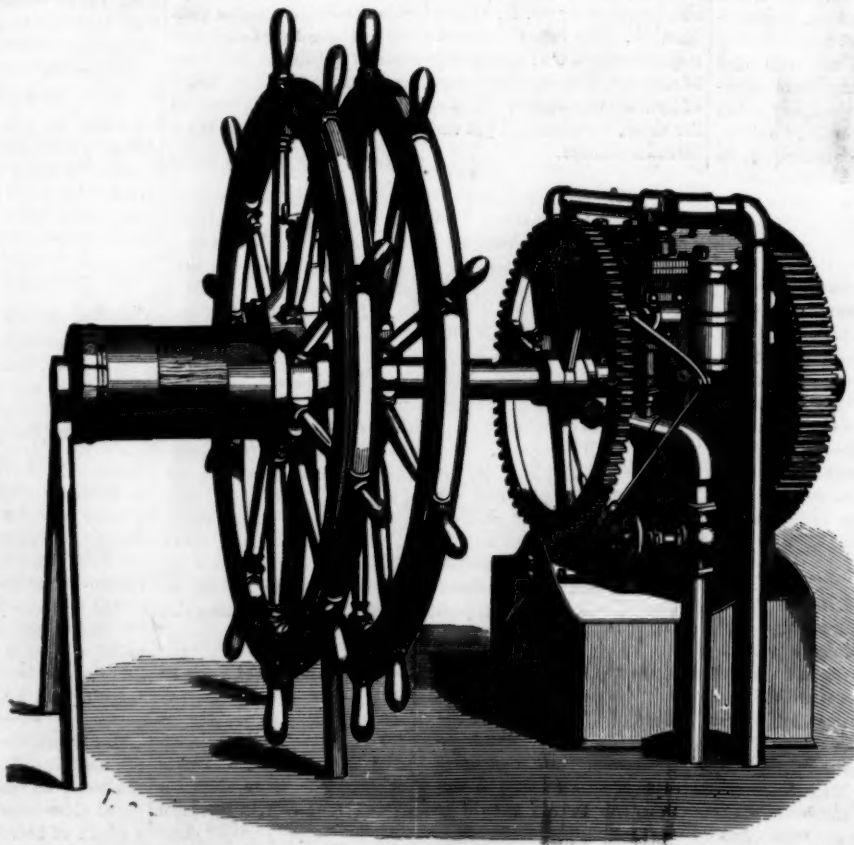


Fig. 1.—SMITH & MASON'S STEAM ENGINE.



doing so by taking advantage of the fact of these vessels being under a foreign flag.

Those visitors to the Centennial, who may make an interesting study of the original machine, will be enabled to judge of the absence of improvements and the perfection of the original model by comparing it with a recently constructed and finely made apparatus of the same description exhibited by the government in the United States building. To the student of the rise and progress of American invention we can suggest no more profitable expenditure, of a part



THE SICKELS STEAM STEERING APPARATUS AT THE EXHIBITION.

the way and overcomes all our mechanical difficulties; in fact, he furnishes us with the honey, while we are the drones in the hive that derive benefit from his labors. Give credit; then, where credit is due. The inventor is the world's benefactor, and as such we take off our hat to him.—*Mining and Scientific Press.*

Oil of Orris Root.

Orris root owes its use during more than two thousand years chiefly to its fragrance, which, curiously enough, does not belong to the living root. Its slight and by no means aromatic smell is first developed into the agreeable perfume after drying, without doubt in consequence of changes of a chemical nature, concerning which at present our knowledge is deficient. When the dried root stock is submitted to distillation with water, eventually there appears upon the water a crystalline odorous matter, which is justly prized in perfumery and is specially prepared by some of the larger distillers. But the yield is very small, only about 1 part per 1000 of the orris root used. The product is of a yellowish brown color, of the consistence of a firm ointment, and possesses the characteristic odor of orris root.

THE HONEY BUZZARD.

The honey buzzard is one of the *falconidae* or hawks, and is known to natural historians both as *falco pernix* (Cuvier) and *falco apivorus* (Linnaeus). It is known throughout Europe; and specimens with a wing measurement of 50 inches are on record, but commonly 20 or 23 inches is the extreme width from tip to tip. The head is always gray, and the eyes, as well as the feet, are yellow. The talons, bill, and cere are black. The plumage on the upper portion of the body is brown; beneath, brown and white mingle indistinctly, while the tail, which is long, is marked with transverse ash-colored bars; the toes are only half feathered. In the female the plumage is similar in color, only very decisively spotted.

The honey buzzard breeds in trees; the eggs are two in number, color gray, with obscure spots. An egg collector came across a nest of one of these birds while in pursuit of his hobby at Selborne, England. In the nest he found but one egg, which was much smaller than that of the *falco apivorus*, not so round, and dotted at each end with small red spots, being surrounded in the center with a broad blood-marked zone.

It must not be supposed that the food of these birds is restricted to honey, which only forms its dessert; but they devote attention to small birds, insects, and reptiles, as well as "rats and mice, and such small deer," and have been known, says a writer in the *Young Fancier's Guide*, from the pages of which we select the engraving, to purloin the eggs of other birds.

A Curiosity in the Baltimore Record Office.

In the course of the examination of titles in the record office to the ground comprised in Federal Hill Park, which will involve a good deal of labor yet before completion, Mr. Warfield T. Browning (assisting the city examiner, Mr. Hensler) yesterday came upon a deed which excited remark among the persons in the office for some curious matters referred to in it. The paper is a deed of trust in the nature of a will from Dr. John James Giraud, who resided on South street, and owned a part of the Federal Hill ground, conveying all his property to John S. Tyson in trust for the wife, heirs, and legatees, of Dr. Giraud. The deed was executed March 16, 1826, but Dr. Giraud did not die until 1837. Among the legatees was Right Rev. Ambrose Marechal,

Archbishop of Baltimore, for several thousand dollars, and the trustees of the poor of the city and county. Among the bequests are two patents, dated January and April, 1831, to Dr. Giraud for "a discovery in mechanism, consisting of a very simple machine of considerable power, for the use of steamboats and other machinery requiring the application of great power. The patent is termed the handle or cylindrical machine, and the machine carries in itself its fulcrum or point of support." He also bequeaths his right in a discovery of a specific or medicine for the prevention or cure of yellow fever, plague, and malignant and pestilential fevers. The deed says its eminent virtues have been proved by three years of operation and trial by order of the government and medical faculty of Havana. Dr. Giraud's memoir on this subject was published in 1835 by William Wooddy, Baltimore. The specific consists of two liquors, limpid, tasteless, and inodorous; they are neither purgative nor emetic, but recall the secretions through the proper excretories, and the crisis takes place by perspiration, etc.

The composition of the liquors, he says, cannot be discovered by chemical analysis, and their discovery was the result of the study and labors of one third of his lifetime. The government at Havana was to have given him, the deed states, \$120,000 for the discovery; but the commotions in Spain and the death of Governor General Mahy interrupted the negotiations. He says he desires the secret to be sold by the trustees for his heirs to some government, and for that

manner that each of the different parts thereof may be properly proportioned and arranged with reference to the particular function which it is designed to fulfill. When this is done, and the work completed, its useful mission has commenced, and inventive talent or skillful instructors need not be employed upon it, unless it should be to modify or add further improvements. Yet, however complete in itself, or however effectually it may perform its work, it is not endowed with the faculty of self-preservation, and, unless it be properly cared for, will be subject to numberless accidents and injuries, involving not only its own immediate or ultimate destruction, but, in many instances, the loss of life or limb to those employed in its operation. This necessary care requires, not the expert mechanic or professional skill, but simply the exercise of common sense. It is by prompt attention to little things that the maximum efficiency and durability is attained, with properly designed and constructed machinery. When the bearings of shafts and the spindles are not oiled sufficiently, not only does the increased friction require a greater amount of driving power, but the bearings are roughened or destroyed in a proportionate degree. When the caps of journal boxes are left too loose, the journal wobbles, and, if there is gearing attached to the shaft, its teeth are badly worn out of shape; while, if the caps are screwed down too tight, the oil is forced out, the journal heats, and both the shaft and bearing are soon rendered worthless. These matters are of no small moment, and the aggregate loss resulting from inattention to them is very great. It is not confined alone to the machinery of mills and other manufacturing operations, but occurs in a very much greater degree in machinery employed in agriculture. Many a thrasher, horse power, or harvester has been branded of bad construction, and been prematurely disabled, when a few drops of oil, or one or two turns of the wrench, were all that were required to set things to rights. Many other items might be mentioned, in which attention to little details, requiring only an application of ordinary common sense, will guard against great and unnecessary waste of power and damage to machinery; but these are sufficient to illustrate the almost self-evident proposition that, while talent is required to originate, and practical knowledge to construct machinery, its most efficient operation, and the profit in its use resulting therefrom, can only be secured by bringing to bear upon its management the plain, ordinary principles derived from every day observation and experience.



HONEY BUZZARDS AND THEIR PREY.

purpose, for the first time, writes down the composition of the recipe. Should any other person, as is not impossible in this age of science and chicanery, be found possessed of the recipe he is to be treated as a fraud, and the trustee is authorized "to prosecute him with all the rigor of the law." The doctor estimated the amount to be realized from the sale of his patents at \$60,000, and directs that out of that sum \$6,000 shall go to the archbishop and \$3,000 to the poor. His sanguine dreams of profit from this source were not realized, however, no government being found to purchase the patent for the specific; and now the missing ingredient is the money that was expected.—*Baltimore Sun.*

The Care of Machinery no Mystery.

The *Mill Stone*, a monthly journal published at Indianapolis, Ind., one of the many good papers printed in the interest of special trades at the West, gives to its readers the following sound advice on the watchful care necessary in operating machinery:

To correctly plan and devise improvements in machinery involves the exercise of a considerable degree of original genius; and to fully develop such improvements, and to bring them into the most practical shape, requires, in addition to this, the application of acquired knowledge of the construction of the machine or mechanical combination, in such

efficient operation, and the profit in its use resulting therefrom, can only be secured by bringing to bear upon its management the plain, ordinary principles derived from every day observation and experience.

Etching on Glass.

M. E. Seigwart has lately given some interesting particulars about etching upon glass.

Since fluoric preparations have been produced at reasonable prices, the decoration of glass by their means has steadily made its way. Etched glass is now to be found everywhere, and glass etching runs glass cutting very hard. It is very easy to understand that well etched objects appear actually more beautiful than those which have been cut. The cost of production is cheaper; and since M. Hock, a Viennese chemist, has given us an elaborate work upon the technics of glass etching, the difficulties attending this kind of work have been reduced to a minimum.

As is well known, fluoric acid usually etches smooth, while other fluoric preparations yield a matt surface. The most beautiful ornamentation is obtained when certain parts of the glass surface are rendered matt by means of fluoride of ammonium which has been slightly acidified by means of acetic acid. The matt appearance is not always the same with different kinds of glass, but varies much in beauty;

this effect is governed by the composition of the glass, lead glasses being easily acted upon, and furnishing a very fine matt surface.

Where it is desired to have the surface of the glass not altogether matt, but shining like ice, as in the case of window glass, this may be attained in a simple manner by placing the glass plate in a perfectly horizontal position and covering it with fine groats. Then very dilute fluoric acid is poured upon it. The groats act as a shield, and produce upon the glass raised points.

Several ways exist of etching photographs on glass. A good result may be secured by covering the surface with a solution of gum made sensitive with bichromate of potash, and printing the same under a negative; after the image has been thus produced, it is dusted over with minium or red lead, and the red picture thus obtained is fixed and burnt in in the usual manner. The easily soluble red glass, so obtained, is treated with strong sulphuric acid, when a white matt design is produced, and the picture appears by transmitted light as a positive.—*Photographisches Archiv.*

Power of Wooden Vessels to Withstand Pressure.

We have lately received a communication from a correspondent at Dayton, O., referring to an unfortunate occurrence, which caused the instant death of one man, and the narrow escape of several others. It seems that a number of men, in the employ of a manufacturer of artificial mineral waters, were in the act of charging a quantity of water, contained in a large iron-bound oaken cask, with carbonic acid gas, at a pressure of 130 lbs. to the inch. The cask, without any previous warning, exploded, with the results above stated. The explosion was sufficiently severe to splinter the cask and the three-inch planking over head. That such accidents are not of more frequent occurrence is to be wondered at; and under such circumstances we cannot but consider the employment of such vessels criminal. We have often cautioned persons against employing wooden casks for this and similar purposes; as it is evident from their construction that, under such conditions of pressure, the whole strain must come upon the hoops and binding clamps, which, unless of extreme strength, could not be expected to withstand such strain as they were placed under in the above instance. Besides, such vessels are always of doubtful efficacy for such purposes, for, where they hold liquids under pressure, even provided it were possible to render every joint tight, the liquid would gradually ooze through the pores of the wood; and if it so happened, as in the instance above cited, that the liquids contained a free acid, the metal bindings would speedily become corroded and weakened, thus rendering rupture, in time, certain.

Should personal and public safety be sacrificed to the mere question of economy? And is the incurring of such risks justifiable by the small advantages derived therefrom? Before more of such deplorable accidents as the one here recorded have occurred, it is to be hoped that the proper authorities will take the matter in hand, and prevent further loss of life from such criminal practices.

The World's Age.

Mr. William Chambers, the veteran author and publisher of *Chambers' Journal*, contributes to that excellent periodical a summary of some of the many views held by scientists as to the antiquity of our world. The *Quarterly Review* treated the same subject recently, and that most conservative of magazines now admits that the ordinary interpretation of the date of the creation, about 6,000 years ago, is to be set aside as untenable and at variance not only with historic and archaeological research, but with the substantial discoveries of geology. The reviewer quotes the opinion that it is impossible that the earth can have existed many millions of years, as the earth is cooling, if not rapidly, at such a rate as to make such an antiquity impossible; and again, there is reason to believe that the earth's rotation is not so rapid as formerly.

The question as to the date of creation must be considered to refer to our solar system alone. The nearest fixed star or sun outside our system—possibly the center of a similar system—is too far off to enter into the question of the age of our sun and its planets and their satellites, being two hundred millions of millions miles away. Sir Charles Lyell gives the date of the Cambrian formation of rocks as at least two hundred and forty millions years ago; while Mr. Darwin assigns to the world a much greater age even than this. Mr. Adams has essayed to calculate the retardation of the earth by the friction of the tidal waves on the atmosphere; and in conjunction with Professor Tait and Sir William Thomson, he allows 22 seconds per century as the time lost by the slackened speed. Mr. Chambers wisely concludes his article as follows: "We can only say that the theories propounded are eminently suggestive, but nothing more. It is not remarkable that there should be differences of opinion among men of science concerning the dark and stupendous questions of the cosmogony of the world. All we deprecate, in the present state of human knowledge, is rash dogmatizing, one way or another."

The Poughkeepsie Bridge.

Progress is being made in the construction of the bridge across the Hudson river at Poughkeepsie, a work, which, when completed, will increase the facilities of travel between Pennsylvania and New England. The coal traffic alone, it is anticipated, will bring in a large revenue to the bridge, as the freight to Massachusetts and other manufacturing States will be considerably reduced.

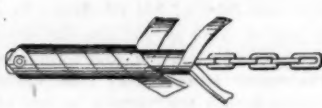
The American Bridge Company is to construct the bridge and its approaches, and the materials for the first caisson are

now being delivered. There will be four piers in the river, built on caissons, the foundation of which will be 85 feet below the surface of the water. The piers will be 525 feet apart, and will be built up of masonry to 130 feet above high water mark. The bridge is to have a double railroad track, a wagon roadway, and a way for foot passengers. It is stated that the Erie railway can cross the Hudson by this bridge and enter New York city, making a *détour* of only 10 miles from its present route, which has the disadvantage of landing its passengers in Jersey City.

CHAIN GEAR AND FASTENINGS.

Our extracts this week from Knight's "New Mechanical Dictionary" include a series of engravings relating to chain, together with others showing forms of fastening rope, etc. These will doubtless prove useful to builders, quarrymen, farmers, and others who frequently have occasion to use tackles, for hoisting heavy weights and for many other purposes.

Fig.



Chain-Belt.

is a chain hook which simply clamps one link between two adjacent ones. Fig. 3 shows how chains are fastened by ropes, when, as in the case of a vessel's cable, they are to be subjected to heavy strains. The upper figure is termed a double and the lower a single chain fastening. These hitches are very strong and not liable to slip. Fig. 4 is a chain pulley having pockets or depressions in its periphery, in which lie the links or alternate links of a chain which passes over and

Fig. 2.



Chain-Hook.

Fig. 3.



Fig. 9.

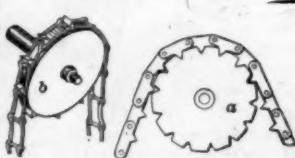


Chain-Pulley.

Chain-Fastenings.

gives motion to or transmits from the pulley. In the chain wheel, Fig. 5, the sprockets of the wheel are adapted to receive the links of the chain successively. The power may be communicated by the wheel to the chain, or conversely.

Fig. 5.



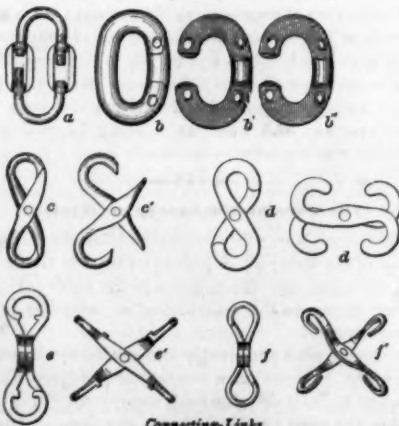
Chain-Wheel.

Fig. 6 represents several forms of

LINKS

capable of being taken apart and thus becoming a means of uniting the broken ends of a chain. Each half of the link, *a*, has a swivel to which it is connected by a head, the swivel of each part forming a nut for the threaded leg of

Fig. 6.



Connecting-Links.

the other portion. The link, *b*, is made of two sections, *b'*

*Published in numbers by Messrs. Hurd & Houghton, New York city.

b'', laid upon each other and riveted. The other figures represent various forms, in which the twin swiveling portions form a mousing for each other.

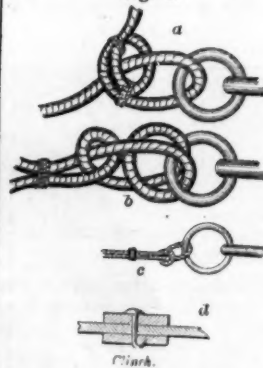
CLEATS.

These are belaying pieces, consisting generally of a bar with two arms fastened to a post or stanchion by a bolt passing through its stem. Those shown at *a*, Fig. 7, are simple belaying pins. *d* is a rope belayed. *b* is a common cleat, lashed in place as shown at *b'*. *e* is a belaying pin or toggle, spliced into the end of a rope to secure an eye upon. Forms of

CLINCHES

are shown in Fig. 8. In nautical parlance a clinch is a mode of fastening large ropes to rings, such as anchors, etc.

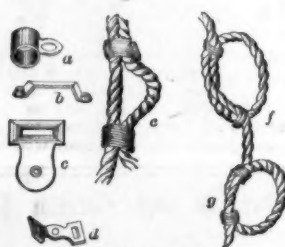
Fig. 8.



Clinch.

tically termed a bastard loop.

Fig. 9.



Loops and Loop-Holders.

rope yarns. *f* is a loop used as a fair leader for ropes, etc. *g* is a bend stopped with seizings.

Gold in America—Its First Discovery by the Pre-Historic Indians.

In a recent speech delivered in the House of Representatives, R. B. Vance, member of Congress from North Carolina, said that the first discovery of gold in the United States was made in Mecklenburg, in that State, in 1820. A correspondent of a North Carolina newspaper corrects this statement, saying that the first gold was found in Cabarrus in 1799, and refers to Wheeler's "History of North Carolina" for evidence.

Old chroniclers give an account of a province called Cofachiqui, which was visited by De Soto's gold-hunting expedition in 1538-40, and which was embraced in what afterward became the States of Florida, Georgia, Alabama, and Mississippi, and, according to Logan, in his history of "Upper Carolina," had its center on the western limits of South Carolina. Its capital and chief town stood upon the tongue of land between the Broad River of Georgia and the Savannah, just opposite the modern district of Abbeville. The Spaniards entered this capital after a two months' march, and found the country ruled by a beautiful Indian queen, Adalla, who entertained the Spanish governor and army with much ceremony. Here they found hatchets formed from an alloy of gold and copper. By this their cupidty was greatly excited, and they concluded that they had found a country abounding in the long coveted precious deposits of gold. And so indeed they had, says Logan (whom we quote freely), but it was neither their good fortune nor their desert to find out the precise spot where gold could be obtained. In less than fifteen miles southeast of the town, on the opposite or Carolina side of the river, lay one of the most extraordinary gold deposits in the world. The Cherokees were well acquainted with the Dora mine. This is shown by the numerous relics of their handiwork scattered around it, and there can be little doubt that the massive nuggets of its outcropping gold supplied them abundantly with the finer metal of the alloy that so attracted the eyes of the Spaniards. It is no less known, to a few who have inquired into the traditions of the aborigines, that the gold and copper, found in their possession, in the form of solid masses or curious trinkets, by the first white men who visited the country, were obtained from these sources.

The Indian method of smelting these metals was one of the most remarkable devices of savage ingenuity; in practical efficiency the famous blowpipe of Dr. Hare was scarcely superior. Logan tells us that, having first hollowed out

flat stone in the form of a basin, they filled it with charcoal, and upon this laid the nuggets of metals. A number of Indians now seated themselves in a circle around the basin, each one having in his hand a long reed pierced through its entire length and armed at one end with a clay tube or pipe. Everything being ready, fire was applied to the charcoal, and the whole mass instantly blown into a powerful heat through the reeds, the clay extremities of which were inserted in the basin, while the Indians blew through them upon the charcoal with all their might, and with protracted expiration. No ordinary lump of either gold or copper could long maintain its solidity in such a crucible. With this process the Indians could easily produce any variety of ornament from those metals, using them either alone or in alloy. This method was known to have been in use among the Indians who lived upon the gold-producing lands of North Carolina, and the same process must have been known to the Cherokees.

These chronicles and traditions go to confirm what Lawson says, that the Indians, from time immemorial, were acquainted with valuable mines of gold and silver in Upper Carolina.—*Columbia (S. C.) Register.*

The American Institute Fair.

The annual exhibition of the American Institute was opened on September 6, at the Institute's building at the corner of Third avenue and 63d street. Very few of the exhibits are ready for public inspection; and there is likely to be, in consequence, a limited number of visitors for the first few days. This want of preparation does great harm to the interests of those exhibitors who make a point of being ready by the opening day, and damages the reputation of the whole exhibition; but we have so often commented on it that it is, we suppose, useless to hope for any improvement.

NEW BOOKS AND PUBLICATIONS.

THE WORLD'S SAGES, INFIDELS, AND THINKERS: being Biographical Sketches of Leading Philosophers, Teachers, Reformers, etc. By D. M. Bennett, Editor of the "Truth Seeker." Price \$3. New York city: D. M. Bennett, 141 Eighth street.

Mr. Bennett has attempted, as this title shows, to classify together the wisest and best of mankind and the fool (or infidel) who "says in his heart: There is no God." The work is of necessity a signal failure. It is not by placing the names of Socrates, Bacon, Locke, and Colenso in juxtaposition with those of Bradlaugh, Holyoake, S. P. Andrews, and Susan B. Anthony, that any connection between brains and atheism can be established; and it would be a far worthier (and a easier) task for a writer to point out the sharp definitive line which separates the moderate and tolerant philosopher from the blatherskite who proves his want of belief in a God by his perpetual and venomous hatred of all who differ from his crude and frequently blasphemous opinions. The author evidently hopes that this book will, in some households, take the place of the family Bible; for he has bound up in it some leaves for the registration of births, marriages, and deaths.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED BRUSH-HOLDING RUBBER STOPPLE.

Ferdinand A. Reichardt, New York city.—This is an improved rubber stopple for bottles, which is so constructed as to serve as a holder for brushes, which may thus be kept within the bottle, and may be exchanged as required. The tapering rubber stopple has its inner end perforated with a tapering hole, to receive and hold a brush handle.

IMPROVED DINNER PAIL AND LANTERN.

David T. Platt, Greenwich, Conn.—This invention consists of a dinner pail with a compartment for heating tea and coffee, contrived to serve for a lantern for the workman going home at night.

IMPROVED CHEESE CUTTER.

Henry S. Jones, Vincennes, Ind.—This invention is a cheese cutter, by which retailers of cheese and others may cut off pieces that will weigh exactly, or nearly so, the amount required, and at the same time cut them of uniform wedge shape, and from the outside to the center. It consists of a circular horizontal revolving table for holding the cheese, with a graduated scale, showing the sizes for different weights, over which is a radial lever cutter, pivoted to a standard attached to the bed piece on which the table revolves, and being adjustable up and down on the standard, to adjust it to the thickness of the cheese.

IMPROVED TELEGRAPH KEY.

James O. Byrns, Jersey City, N. J.—This is an improved duplex key, by which the time taken up by the upward motion of the present key may be utilized, and the sending of the messages be accomplished in about half the former time, and with greater facility and ease. The invention consists of two horizontal and spring-acted keys, whose contact points alternately close the circuit by contact with an intermediate post, the keys being out out, when not in use, by the rear set screws bearing against a double post with a dividing insulating layer. The contact of either key closes the circuit, so that by the alternate wording of the keys the working of the hand is utilized in both directions for the transmission of telegraphic characters.

IMPROVED CANNON.

Richard B. H. Leighton, Jersey City, N. J.—This invention is a cannon so constructed as to scatter the shot in a horizontal line. It is provided with a wide, flaring, and shallow bore, and is formed of top and bottom plates, side pieces, and breech piece, riveted to each other. In the inner side of the bottom plate is formed a transverse groove to receive a rib formed upon the lower side of the shell of the cartridge, to keep the cartridge square when putting it in, and also to prevent the cartridge shell from being blown out when the cannon is discharged. Round or square, grape or chain shot may be used, as desired. It is claimed that, with this construction, the wide shallow, flaring bore will scatter the shot in a horizontal line, so that it will do much better execution than when a bore of the usual form is used.

IMPROVED COMBINED BUCKLE AND SNAP.

Richard St. L. B. Chinnery, Kankakee, Ill.—This improved buckle and snap is for connecting the reins to the bit rings, and is so formed that it may be colored to represent leather. It consists of the long bent metal strap, the short straight metal strap, the spring, and the buckle, constructed and combined with each other.

IMPROVED ICE CREAM FREEZER.

Charles L. Dexter, Philadelphia, Pa.—This improved machine for making ice cream is so constructed as to operate upon the cream, while freezing, in about the same way as when it is made by hand. This is effected by the combination with an ice cream freezer, of an outer tub having arms, friction rollers, and angle irons, with the inner revolving can and the necessary operating gearing.

IMPROVED CIGAR BOX.

Thomas A. Dodd, Providence, R. I.—The object is to furnish an improved cigar box, which shall be so constructed as to allow the ends of all the cigars in it to be seen, as well as the top layer. The invention consists in a cigar box provided with a glass front, and having a flap hinged to the forward edge of its top, to shut down over said glass front to prevent breakage.

IMPROVED WEIGHING SCALES.

Alonso Pangburn, Fremont, Ohio.—This consists of one or more beams, in combination with the ordinary beam, connected by suspending the short arm of the additional beam to the long arm of the preceding one, under which it is located, in such manner that the range of the scale can be increased to any extent required. It also consists of a secondary beam to the principal beam for weighing small articles.

IMPROVED COMBINED BUCKLE AND SNAP HOOK.

Francis J. Delsz, Piorce City, Mo.—This is an improved buckle and snap hook, for connecting a breast strap with the hames in such a way as to be easily attached and detached, and which will hold the straps securely. Any strain upon the strap causes a wedge block to clamp it more tightly and hold it more securely, a tongue preventing the strap from slipping before the wedge block has clamped it firmly.

IMPROVED REVOLVING BILL HOLDER.

Sylvester W. Maynard, Kingston, N. Y.—This furnishes a neat and compact device for filing bills, receipts, and other papers, in such a manner that they are instantly and conveniently within reach. It consists of a number of receptacles, with spring-acted covers arranged around a central section or case, and revolved or locked by a sliding and spring-acted shaft and fastening device.

IMPROVED HAME.

August H. W. Michaelis, Monroe, Mich.—This invention consists in breast strap rings attached to the hame tug clips, and in the fastenings provided with the guards and the pins and the loops, in combination with the perforated upper part of the hames, for connecting the hame strap adjustably with said hames.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BRICK MACHINE.

Richard A. Drawdy, Jacksonville, Fla.—This invention consists in two parallel rollers geared to each other, revolving toward each other, placed in an opening in the bottom of the mud box of a brick machine, and driven from the shaft of said mud box by suitable connecting gearing, and also in the combination of the platform and its rollers with the frame, the mud box, and the rollers of a brick machine, so constructed as to force out the clay into the molds with a continuous pressure, so that there can be no imperfectly filled molds, as there will be when the bricks are molded with an intermediate pressure.

IMPROVED ORE-STAMPING MACHINE.

John Patterson, Belfast, Ireland.—In stamping of minerals and metals there is much difficulty experienced, owing to the substances under operation, when finely divided, getting into the bushes or guides of the stampers, and not only causing much increased friction, but wearing away the said bushes or guides and stamp rods; and in stamping of animal and vegetable substances and textile fabrics and fibers, great inconvenience is experienced from the dropping of the lubricating material on to the substances to be stamped. In order to overcome the above injurious effects, the inventor employs vibrating levers to transmit the motion of the crank shaft, through springs and flexible connections, to the stampers.

IMPROVED DOOR LOCK.

Moses C. Hawkins, Edinborough, Pa.—This lock may be used as a fixed tumbler lock or as a combination lock, in combination with keys having fixed or interchangeable bits. It thus may not be easily picked or tampered with. There is a sliding bolt, with interchangeable tumblers pivoted thereto, and so connected to the casing by a detachable screw that bolt and tumblers may be taken out from the casing for changing the combination. The invention consists, further, in the combination of the sliding and notched bolt and the notched tumbler, pivoted thereto, with a swinging fence plate and rigid fence bar, that enters all the notches when set by a combination or reversible key. The reversible key may be finally locked to the inside of the lock by a revolving escutcheon.

IMPROVED PISTON FOR SYRINGES, AIR PUMPS, ETC.

Reinhold Vander Emde, New York city, assignor to himself and Charles E. Koechling, same place.—This invention consists of a piston rod provided with shoulders and elastic collars, that hold intermediate leather washers placed over the same. The washers and collars are readily replaced when worn out by long use, but keep up their working capacity for a long time by the action of the rubber, without getting loose.

IMPROVED WINDMILL.

Daniel Nyswander, Springfield, Ohio, assignor to himself and David Nyswander, same place.—This invention consists in making the vanes of windmills from sheet metal, of such form that it is possible to attach the points, which are bent over toward the center, to a central plate which is fixed on the end of the shaft. Weights are provided at the extremity of the arms, for balancing the wheel and giving it additional momentum when in motion. There is also a convenient device for changing the relative position of the guiding vane, making it possible to control the motion of the mill by this means.

IMPROVED WATER WHEEL.

Leonard Long, Princeton, Wis.—This consists, mainly, of buckets arranged between an interior cone hub and an exterior cone cylinder, the buckets extending from an outer top flange of the inner cone on an inclined segment of a circle to the cone cylinder, and then on an inward and downward spiral curve to the bottom of the same and the lower part of the cone hub.

IMPROVED WATER WHEEL.

Burrell C. Lambeth, Thomasville, N. C., assignor to himself and I. L. Younce, same place.—This consists of a novel contrivance of the alternate gates to form chutes, and the device for opening and closing them is contrived to reverse, for application to wheels running either way. The buckets are provided with spring valves, to regulate the opening according to the volume admitted, so that the water will be applied to the wheel in an effective manner, whether the whole or part gate is used. The wheel is constructed so that it can be reversed to run either way by shifting the attaching disk from one side to the other. The socket of the step has a flat bottom, and the pivot on which it turns has a corresponding flat top. The bearing for the shaft above the wheel consists of

boxes let into slots in the tube of the case, the boxes being tapered from bottom up, and being clamped against the shaft by a ring of corresponding form. The case is also reversible by taking off the top and attaching it to the other side.

IMPROVED CUT-OFF FOR STEAM ENGINES.

Julius C. Debes, Jackson, Mich.—This relates to that class of cut-off in which the stroke of the cut-off valves is controlled by the governor; and it consists of a plate placed on a central stud in the steam chest, and provided with oblique slots, which engage with studs on the back of the cut-off valves, varying the time of the admission of steam according to the position of the plate which is varied by the governor.

IMPROVED CAR COUPLING.

David P. Cubberley, Marion, Ind.—The improvements consist in making the latch in the form of a bar of a comparatively small transverse dimension and inclining its rear end (against which the link bears) upwardly, and to the front, so as to cause the link to rise when the draft is exerted and occupy a position more in alignment with the greatest strength of the latch bar, whereby a much lighter latch may be employed, and the manipulation in disengaging the link rendered easier, and whereby also the draft strain is made to assist in holding the latch down.

IMPROVED CAR COUPLING.

James H. Wood, Baltimore, Md.—This invention consists in providing a drawhead with an armed shaft that couples and uncouples with the hook bar, a presser board hinged to the front of the drawhead and forming the cover thereof, and a crank that lifts the presser bar at the same time that it raises the coupling bar. These features of improvement render automatic couplings, heretofore regarded as impracticable, easily manageable and little liable to get out of order.

IMPROVED BELT SHIFTER.

Augustine Crosby, Benton, Mo.—This invention is an apparatus for shifting belts for stopping or starting machinery; and it consists of a roller supported in a frame that is placed parallel with and near the tight and loose pulleys on the counter shaft, and is pivoted so that the roller may be made to bear against either side of the belt according to the direction in which the belt is to be shifted. It further consists of an arrangement of a rack and toothed sector, by means of which the roller is moved. The advantages claimed for the invention are that with it belts can be shifted without being subjected to wear, that it is particularly adapted to rubber belts, as it does not chafe them, and that it shifts the belt smoothly, without jarring or noise.

IMPROVED IMITATION STITCH MACHINE.

Edwin Brown, Georgetown, Mass.—The object of this invention is to make what is known as the "imitation fair-stitch" on boots and shoes, that is, indentations on the upper margins of the soles, having the appearance of the stitches by which the soles are sewed on in hand work. It consists of a milled indenting roller on the end of a crank shaft, under which is a carrying roller, made to slide up toward the milled roller by a lever which is to be worked by foot power, to carry the sole and press it against the milled roller, which, being turned by the crank, makes the indentations or imitation stitches, at the same time feeding the work along. The milled roller and its shaft-carrying roller and the lever are all attached to a plate, which may be readily attached to a bench or other suitable support, making, it is claimed, a simple and cheap machine.

IMPROVED AUTOMATIC FERRY BOAT COUPLING.

Thomas D. and George E. Husband, Green Point, N. Y.—This is an improved device for connecting a ferry boat to its bridge, so constructed that it will couple itself as the boat comes into its place, hold the boat securely, and may be easily uncoupled to release the boat when desired. The invention consists in the combination of the sockets, the hooks, the springs, and the levers, with each other, and with a ferry boat and bridge, and in the combination of the wheels, the recesses, and the guide bars, with the ferry boat and bridge for guiding the hooks into the sockets to interlock with the other hooks.

IMPROVED PEG FLOAT.

James Popham and Ebenezer Popham, Montreal, P. Q.—This is a machine for breaking or cutting the projecting ends of pegs from the insoles of boots and shoes; and consists of a grooved cutter, of pyramidal or cylindrical shape, attached to the end of a rapidly revolving shaft, in connection with a protecting guard or casing. The cutter serves to cut off the pegs of long boots, and is for this purpose made cylindrical, with grooves and cutting blades at the circumference, for cleaning the peg ends from the sides instead of downwards, and with the pyramidal cutter. One and the same machine may thus be applied, without any special adjustment, to every variety of pegged work, from children's wear to the largest and strongest goods in men's sizes.

IMPROVED DEVICE FOR PUNCHING MACHINES.

Louis Prahar, New York city.—This invention is so constructed as to feed the material forward to the cutting tool as it is required. This is effected by the movement of a pendulum operating feed rollers to carry the material forward to the cutting tool, the rapidity of the feed being regulated by the size of gear wheels.

IMPROVED SHAPING ATTACHMENT FOR ENGINE LATHES.

William Brede, Lihue, Island of Kauai, Hawaiian Islands.—This invention is an improved shaping attachment for lathes, so constructed as to do all the work required by an iron or brass worker, while saving the space that would be occupied by a shaping machine, and at the same time being much less expensive. It consists in the combination of the slotted plate, the arm provided with a dovetail tongue, the blocks, tool holder, and swiveled screw, and the connecting bar, with each other, to adapt them to be applied to the face plate, spindle, and frame of a lathe; in the table provided with the lug, the bent arm, and the adjustable cross bar, to adapt it to be applied to the lathe bed, the carriage, and the frame of a lathe; and in the combination of the cam wheel, the bent lever, the connecting bar, the slotted bar provided with the collar, and the pawl, to adapt them for attachment to the friction wheel and the feed screw of a lathe. For heavy work, the attachment may be strengthened by a brace bar, the forward end of which is bolted to the forward end of the arm, and its rear end is bolted to the bracket or bearing of the lathe.

COMPOSITION FOR LINING PUDDLING FURNACES, ETC.

Marie Eugène Paul Audouin, Paris, France.—This invention is a composition or substance calculated to more effectually resist the action of oxide of iron than any other material heretofore employed for the purpose. This material is oxide of chromium, which is capable of resisting the very highest temperatures employed in furnaces and laboratories—such as the Siemens furnace and furnaces heated by dead oils—and is also proof against the action of oxide of iron at the highest degrees of heat. The inventor claims that there is no danger of the oxide being reduced under the ordinary conditions of working, and, moreover, the presence of a small quantity of chromium will not affect the quality of the iron. This oxide may also be utilized in the manufacture of fireproof blocks to be exposed to the action of furnace cinder and scoria, but with less advantage, as, by the action of certain principles, more especially potash, soda, and lime, chromates are eventually found.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED BENCH PLANE.

Jackson Gorham, Crawfordville, Ga., assignor to himself and Charles E. Smith, of same place.—This invention consists of a stud applied on the top of a smoothing plane stock near the heel, and adapted to fit between the thumb and forefinger of the right hand, while the palm bears against the heel of the stock, whereby the pressure of the hand is distributed over a larger surface, and is thus diminished on the small area heretofore employed for driving the plane by pressing against the heel of the stock. It also affords a bearing or rest for a part of the hand not heretofore having any support on the stock, and therefore making the work easier.

IMPROVED LATH MACHINE.

Edmund H. Hancock, Augusta, Ga.—The invention consists in placing edge-serrated planes in advance of a saw, to cut grooves, in attaching the upper grooving plane to a pivoted shoe provided with a handle, and in combining collared rolls with spiral feed rolls having a right-angled groove next to the collars. The sides of the grooves of the rollers, next to the guide collars, are out at right angles to the axis of the collars, the taper being all on the other sides, whereby they draw towards the collars better than if beveled alike on both sides. Guard fingers prevent the saws from throwing sticks back against the attendant, which is a common occurrence in gang saw machines, particularly when the saws are out of order; these fingers are pivoted to the frame over the way where the stuff passes, and rest on the stuff in such manner that the friction of a piece of lath or other object pushing back under them causes them to bind it fast and thus stop it.

IMPROVED BRAKE FOR LIGHT VEHICLES.

Charles H. Appel and Joseph S. Rothenberger, Shimerville, Pa.—This improved brake has all of its parts connected with the shafts and front axle, so that the springs are subjected to no strain when the brake is operated, and the arrangement of the parts such that they are out of the way and not liable to be bent or broken from contact with any object. In applying the brakes there is no strain upon the springs, as there must necessarily be when the brake is attached to or connected with the body of the vehicle.

IMPROVED SAW SET.

Christopher Heinen, Fort Laramie, Wyoming Ter.—In this saw set a number of teeth may be set in opposite direction at one operation of the device, and the same be adapted to set any kind of saw by inserting the dies fitted to the saw. The invention consists of a lower base part and a swinging lever part, with removable dies, gage piece, and regulating screw. The saw is set into the dies from right to left, and the lever then brought down to set the teeth. The person operating the set stands in front of the same, adjusts the saw, and brings the lever down without changing his position, setting the teeth thereby directly at one operation, in opposite direction, without reversing the saw or saw set.

IMPROVED ELEVATOR.

John G. Kurtz, Milton, Pa.—This is an improved elevator for use by carpenters, masons, and painters, for raising their materials and themselves upon buildings, in stores, hotels, and other buildings, and by firemen and others; and it consists in a standard made in sections, and provided with a T groove, the jointed rack bar, and the gear wheel, in combination with each other and the frame, and a mechanism for turning the said gear wheel; in the combination of the springs, the pins, and the cam levers, whether the second set of springs be used or not, with the hinged ends of the sections of the standards; in the combination of the bar, the arm, and a platform, gallery, or cage with grooved standard, and with the jointed rack bar and the gear wheel; and in the combination of the spool and the coiled spring with the jointed rack bar.

IMPROVED DUST GUARD FOR CARS.

William Carr, New York city.—The inventor's object is to furnish for the traveling public a portable dust guard for railroad cars, which may be readily attached to the window of a car so as to prevent the annoyance by cinders, while it also may be used as a fan and readily folded up after use, for being carried in the pocket. The invention consists of a guard made of a number of folding pieces or strips, that are rigidly connected by a clamp piece, pivoted to one strip and fitting over the ends, which folds with the strips when released. When the dust guard is detached, it may be used as a fan, and finally be folded into narrow compass, for being carried in the pocket, by releasing the clamp piece from the ends and folding it alongside of the strips. The strips may also be made available for advertisements, so that the dust guard may be used as a convenient advertising medium for the traveling public.

IMPROVED PRIVY SEAT.

Peter D. Howard and Matt. Allard, La Porte, Iowa.—Should a person attempt to stand upon this seat, to use the privy, the seat will tilt, and thus the seat will always be kept clean.

IMPROVED WAGON BRAKE.

Frank Funk, Beverly, Ill.—This invention consists of a lever connected with a fulcrum bar and brake rod, all so arranged that the power is gradually increased, as the brake is pulled by the brake rod connected with it against the wheel. The propelling lever is provided with a longitudinal projection or detent to lock the brake by engaging with a rack bar attached to the side of the wagon.

IMPROVED CHIMNEY COWL.

Jacob M. Davies, Enon Valley, Pa.—This invention consists of a pipe elbow, fitted to turn on a spindle on the top of the chimney, constructed with that portion through which the smoke escapes in a form calculated to be equally as efficient as the hood or funnel commonly used to facilitate the discharge of the smoke, and to be less liable to catch the wind, when contrary and shifting gusts prevail, and conduct it down the chimney into the room, which is so common with the ordinary cowl.

NEW AGRICULTURAL INVENTIONS.

IMPROVED ANIMAL TRAP.

Jacob W. Wilson, Summerford, Ohio.—This trap is so constructed as to close when the animal enters the first compartment, to prevent his escape, and set itself when the animal enters the second compartment or cage. The invention is formed by the combination of the swinging gates, the cranks, the connecting rods, the weighted platforms, and the bent arm with the box of the trap and with the gate hung in the opening through the partition of said box.

IMPROVED POTATO DIGGER.

Edward Bartlett, Renfrew, Ontario, Canada.—This invention consists of arrangements of colters for cutting along the sides of the row of potatoes, a scoop for digging them up, a revolving spout or reservoir for separating them from the earth, beaters for preventing the clogging of vines and wood on the scoop, a contrivance of the separators for discharging the potatoes into a spout, apparatus for separating and discharging the vines and weeds, and a discharging apparatus for removing the filled boxes which receive the potatoes from the spout, also supporting, operating and adjusting devices.

IMPROVED WEANING BIT FOR ANIMALS.

George W. Ingersoll and Harvey L. Fisher, Toledo, Iowa, assignors to Jacob L. Neff and Henry Giebert, of same place.—This is an improved weaning or anti-suction bit for calves, by which the animal is prevented from sucking, and no incumbrance caused to the same in eating and drinking. The invention consists of an outer hollow tube with air holes at the central part, and open ends with an interior revolving tube with central air holes and open weighted ends. The air holes are not liable to get clogged, so as to exclude the air and supply the air at every attempt at sucking, thereby preventing it and weaning the animal. When the animal holds its head in a downward position for eating and drinking, the inner tube is turned by the weights, and the air supply interrupted as the connection of holes of the inner and outer tubes is discontinued. This automatic interruption of the air supply of the bit forms the main feature of the invention, as thereby not the slightest inconvenience to the animal in drinking is produced, and the same is not compelled to put its whole nose into the water to exclude the air, which forms a serious objection to the bits at present in use. The friction of the inner and outer tubes prevents the clogging of the air holes, and secures, in connection with the weighted tube, the reliable working of the bit, namely the opening of the air supply holes to prevent sucking, and the closing of the same during eating and drinking.

IMPROVED HARROW.

Jackson De Moss, Noblesville, Ind.—This invention is a harrow or pulverizer, which is claimed to thoroughly pulverize the ground and adjust itself to an irregular surface, so that it will level down a ridge or fill up a dead furrow with equal effectiveness, which may be easily cleared of rubbish, raised to pass an obstruction, and may be easily loaded upon and unloaded from a vehicle for transporting it from place to place. By removing the teeth from the central beam the harrow may be used for cultivating small corn, or other small plants planted in rows, loosening the soil upon both sides of the row at the same time; and by removing a pin from a hook, the harrow will come apart, and may be easily loaded upon a vehicle.

IMPROVED WAGON COVER.

Charles Cremer, Red Bluff, Cal.—This is an improved cover for the boxes of wagons, cars, and other vehicles for transporting swine, calves, sheep, fowls, etc., constructed so as to allow the air to have free passage to the animals, while confining them securely. The invention consists in the combination of the net, the four rods, the connecting snap hooks and rings, and the holding snap hooks, with the body or box of a wagon, car, or other vehicle. By this construction the animals are securely confined, and at the same time have the benefit of a free circulation of air. The rear end board of the box may be removed to allow some of the animals to be taken out or others put in, while guarding against the escape of any.

IMPROVED SULKY PLOW.

Alexander Hamilton, Harrisburg, Ark.—This sulky plow is constructed that the plows may be readily raised from the ground, drawn back from an obstruction, and adjusted to work any desired depth in the ground.

IMPROVED PLOW STOCK.

James A. Price, Houston, Tex.—This improved plow stock is so constructed that any kind of a plow and standard may be applied to it, according to the kind of plowing to be done. Each plow is designed to be attached to its own standard.

IMPROVED GATE.

Uriah W. Hardy, Albion, Ill.—This is an improved farm gate that may be readily opened and closed by a person on horseback, and from the seat of a vehicle. Fulcrum levers that extend alongside of the road operate, by rods, bars, cords, or chains, a folding or weighting gate. A separately pivoted latch piece at the upper part of the gate locks into the recessed post when the gate is lowered.

IMPROVED MILK COOLER.

Thomas Sexsmith, Oneonta, N. Y.—This consists of an elevated cooling compartment in the bottom of the pan which holds the milk, into which the cooling medium is delivered by an inlet pipe, so arranged that the said medium is discharged directly upward from the mouth of the pipe against the shell of the compartment. The discharge passage leads out from the bottom of said compartment, to which the warmer part is forced by the incoming part being discharged between it and the shell of the compartment. The invention also consists of a contrivance for mounting the pans on their supporting stools, so that they can be readily leveled up in case the stools are not level.

IMPROVED GRAIN SEPARATOR.

Thomas C. Jory and John W. Jory, Salem, Oregon.—This separator is designed especially for cleaning wheat, but will, by proper adjustment, separate oats from wild oats. It involves in construction the following four principal features: First, a regulating and distributing feeder, by which the same amount of grain flows from the hopper at each turn of the crank, and is evenly distributed over the entire surface of the cleaning apparatus; second, an arrangement by which cockle and other small seeds are separated from wheat, the same being a revolving cylindrical screen, through which, as it revolves, the grain is conveyed by a spiral flange closely fitted to its inner surface throughout its entire length, and a plain hollow cylinder of sheet iron, surrounding the screen and concentric with it, and having a flange working in the opposite direction to receive and discharge the seeds, small grain, etc., at the opposite end. Thus the wheat flows from one end of the revolving cylinder, and the small seeds from the other, and both may be collected in proper receptacles. Third, an arrangement for keeping the screening apparatus clean by a vertical shake communicated to it (as is also its rotary motion) by cam wheels revolving under each end of the screen. Fourth, the carrier is kept free from wild oats, etc., by means of stirrup-shaped knockers, which strike a quick, light stroke on the under surface of the carrier at each descent of the screen, from which it takes its motion.

NEW HOUSEHOLD INVENTIONS.

IMPROVED FOLDING CHAIR.

Adlie Matthiessen, Cornwall on the Hudson, N. Y.—This chair has a back piece, to which are hinged the seat and arms. The front legs are hinged to the seat, and a brace is pivoted to the back legs in such a way as to be capable of holding the various parts in their places. The principal object of the invention is to furnish a convenient nursery chair, which can be folded and placed in a trunk.

IMPROVED DESK.

Charles A. Atkinson, New York city.—This consists in a desk made in sections, so constructed that they may be connected and disconnected at will; and in the combination with the main desk, of one or more side sections or wings, so constructed and hinged that they may be closed against the sides of the said main desk, moved forward to expose their contents, and swung back out of the way while still exposing their contents.

IMPROVED COMBINED DISH AND CLOTHES WASHER.

Asberry C. Jackson, Orange, Texas.—This is a detachable clothes washing attachment for a sink, and a tilting shelf, upon which dishes may be placed for draining off the water into the sink. The wash pan and the draining shelf are surrounded on the sides and top by a cabinet case, which is located in this relation thereto for convenience in storing away the dishes.

IMPROVED FOLDING CHAIR.

Frank F. Parker, Gardner, Mass.—This consists of a folding chair made of a back section, that is pivoted by its recessed ends to fixed projecting pins of the swinging rear leg section, while the front leg section is extended above the seat pivoted to the back, and hinged by a lateral cross piece to staples of the rear leg.

IMPROVED APPARATUS FOR AUTOMATICALLY LIGHTING AND EXTINGUISHING GAS.

Asahel P. Bell, Manchester, and Thomas Thorp, Whitefield, England.—In this invention, a metal cap is secured to the gas main, and wool or other fibrous material acts as a filter for the gas. A receptacle, made of earthenware or other suitable material, contains mercury. The gas from the main passes into the receptacle through vertical holes, all of which may be left open, or some may be closed according to the differences of pressure in the gas main. A center piece, in a recess in the receptacle, contains a chamber for mercury, and this chamber has an orifice, above which is a hollow cylinder, and a second orifice, in which the burner for the flaring jet is fixed. At the lower side is a pipe mouth valve, through which the gas passes into a tube provided with an ordinary burner. A hollow cylinder is fixed to a metal shell suspended to the burner by wire, and a loop of platinum wire, connected thereto, is carried over the burner. When the gas is at its maximum pressure, it depresses the mercury in the center compartment of the receptacle, thereby uncovering a valve and allowing the gas to enter the tube. A small portion of it passes through an aperture to a small interior burner, and this portion of gas is then ignited by the jet and a second platinum wire. The flaring jet from the small principal burner then ignites the gas issuing from the burner. When the cylinder is heated by the wire passing through the flame, the inclosed air expands and expels the mercury, which falls into the chamber and closes the aperture and shuts off the gas.

IMPROVED EXTENSION BEDSTEAD.

Rudolf Rigi, Dobling, Austria, assignor to Franz Xaver Katzmayer, Vienna, Austria.—This invention is an iron sofa bed, for hotels, boarding houses, etc., that may be readily changed from a sofa to a single bed, or to two connected beds, or to two entirely detached beds, as desired, the whole forming a strong, compact, and convenient sofa bed for various purposes. When the sofa covering is taken off, a telescoping section may be used as a single bed. When it is desired to make two separate beds, the sliding action is taken out of the frame, and a foot support clamped or otherwise attached to the end section that has been taken out of the main frame. The sliding section forms thereby a separate bed, which may be put up in a different room from the main frame, to be replaced at any time by detaching the end support and sliding the bed section back into the main frame, storing the whole in convenient manner below the covering, and allowing the use of the bed as a sofa.

IMPROVED COMBINED STOVE PIPE THIMBLE AND REGISTER.

Charles Pettit, Erieville, N. Y., assignor to himself and Levi P. Greenwood.—This invention consists of a large tube extending through the ceiling and floor, and having a top and bottom plate, through the center of which the pipe passes in a center tube, which is surrounded by a larger tube and a dead air space, or a lining of non-combustible material, to confine the heat, so as to prevent the heating of the floor through the outer tube. The top and bottom plates are provided with openings to allow the air to pass for ventilating and for heating, and one is provided with a register.

IMPROVED SEWER GAS TRAP.

John M. Falk, New York city.—This invention consists of a trap, similar in form to the ordinary trap, or of any other approved form, except that it is preferably larger, and located near the sewer, from the upper end of which is an escape pipe for the gas that may work through the trap, and with or without another trap above the escape pipe to check the gas escaping through the first trap and cause it to escape through the pipe provided for it, which pipe may discharge in any convenient place, such as the gutter or the chimney of the house.

IMPROVED SUMMER STOVE.

Charles H. Chase, Newport, R. I.—In this invention, a fire pot, of any suitable form or construction, large enough to cover the pot hole of an ordinary stove, is made flat on the top, and has an opening therein, in which a cooking pot may be set, and which may be closed by the cover removed from the pot hole of the ordinary stove on which the stove is set. The smoke passes through a damper into a diving flue to escape into the large stove, so that the flue of the latter serves for the flue of the summer stove. An oven may be used in connection with this stove for baking. It is detachably set on the top of the stove, and has a flue passing around it from the opening through its bottom, where the smoke enters, to another opening, where it escapes into the diving flue and passes off as when the oven is not used, the damper being closed when the oven is used.

IMPROVED STEAM WASHER.

Cyrus C. Carter, Neeleyville, Ill.—This invention is claimed to be so constructed as to enable the clothes to be washed evenly and thoroughly, with much less fuel and in much less time than when they are washed in the ordinary way. It consists in an improved steam washer, formed of the flat base or bottom, the inclined sides, the V-shaped concave top, the rounded and inclined ends, and the vertical plates, and provided with the holes to adapt it for use. In using the steamer, water is put into it and heated. The steamer is then placed in the boiler, the clothes are put around and over it, and in a few minutes the clothes will be thoroughly and evenly cleaned, and may be wrung out to dry, the peculiar form of the steamer causing the steam to pass through all parts of the said clothes.

IMPROVED WASHING MACHINE.

John Zeller, Stouchsburg, Pa.—This machine is so constructed as to rub the clothes in a manner analogous to hand rubbing, will enable soiled parts to be rubbed longer than the cleaner parts, and will not injure the clothes.

IMPROVED FRUIT AND JELLY MASHER AND STRAINER.

Adolph Conrad, Cincinnati, Ohio.—This consists in a metal cup with perforated sides, in which is a press follower, with a screw for working it. The screw is mounted in a cross-tree, detachably connected to the top of the cup, so as to be readily attached and detached, to facilitate the application and removal of the follower for filling and clearing out the cup.

IMPROVED COOKING STOVE.

John C. McClamroch, Edina, Mo.—This relates to an ash box located below the perforated bottom of the ash pit, and provided with a register in its side to admit air, so that the ash box may be utilized as a fire box.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R. H. Allen & Co., N. Y.

Chester Steel Castings Co. make castings twice as strong as malleable iron castings at about the same price. See their advertisement, page 205.

Glass—Instructions given in etching and frosting; also stencil etching. T. J. Calnin, 31 Albany St., Boston, Mass.

Shaw's accurate and U. S. Standard Mercury Gauges, Steam, Vacuum, Hydraulic, and Test Gauges. &c., 915 Ridge Avenue, Philadelphia, Pa.

Wanted—A small Water Power Engine. Address George Austin, Post Office Box 4,000, New York City.

Wanted—Party to manufacture an Automatic Cut-off Governor on Royalty. A perfect cut-off. Can be made as cheap as Judson Governor. Has been tested. Address H. S. Cole, 617 Hill St., Milwaukee, Wis.

Foundrymen—A good Dry or Green Sand Moulder wants a job. Address C. F. Field, 347 Grand St., Brooklyn, N. Y.

Models and light Machinery made by T. R. Almond, 14 Water St., Brooklyn, N. Y. Charges reasonable.

Good 2nd hand Drop Hammer, 2 to 300 lbs. drop. Description and lowest price. John Forbes, Dartmouth, N. S.

The best Sewing Machine in the world—Makes the Lock Stitch, the Chain Stitch, and Embroidery Stitch from two whole Spools. Agents wanted everywhere. G. L. Du Laney & Co., 744 Broadway, New York City.

Picture-frame Machine—Something new. Makes 5 frames easier than 1 by the common way. Address E. L. Eastman & Co., Montpelier, Vermont.

D. Frisbie & Co. manufacture the Friction Pulley—Captain—best in the World. New Haven, Conn.

A Scraper Patent for Sale. Address R. Verca, 88 Wall St., New York.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 39 Park Row, New York.

Glass Blown Cylinders. T. Dognan, 129 Milk St., Boston, Mass.

Models for Inventors. H. B. Morris, Ithaca, N. Y.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 299 W. 27th St., N. Y.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 30 Water Street, New York.

Pat'd Graining Stencils—J. J. Callow, Cleveland, O.

Lathe Dogs, Expanding Mandrels, Steel Clamps, &c., for Machinists. Manufactured by C. W. LeCount, So. Norwalk, Ct. Send for reduced Price List.

Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Aray, 148 North Third St., Philadelphia, Pa.

For 2d Hand Portable and Stationary Boilers and Engines, address Janus Harris, Titusville, Pa.

Yacht and Stationary Engines, sizes 2, 4, 6 and 8 H. P. Best for price. N. W. Twiss, New Haven, Conn.

Patent Scroll and Band Saws, best and cheapest in use. Cordesman, Egan & Co., Cincinnati, Ohio.

Hydrant Hose, Pipes, and Couplings. Send for prices to Bailey, Farrell & Co., Pittsburgh, Pa.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hall & Belden Co., Danbury, Ct.

Power & Foot Presses & all Fruit-can Tools. Feracuta Wks., Bridgeton, N. J. & C. 27, Michy, Hall, Cent'l.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Wrought-iron Beams, &c., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Boring metals. E. Lyon, 470 Grand Street, New York.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Temples and Oilcans. Draper, Hopedale, Mass.

Notes & Queries.

O. J. H.'s letter has been placed in the hands of a prominent physician for reply.—C. W. J. should obtain the best medical advice.—W. R. will find a recipe for a black walnut stain on p. 90, vol. 32.—W. N. will find directions for making concrete gravel walks on p. 50, vol. 32.

(1) J. L. C. says: I have a surveying compass, the needle of which does not traverse well. What is the cause, and how can I remedy it? A. It has probably become demagnetized. You should have it charged again.

(2) G. W. D. says: Referring to your recent descriptions of reflectors and to the article in your paper of November 28, 1874, entitled "A Possible Improvement in House Heating," I beg to inquire if any considerable increase of heat could be obtained by massing, by means of reflectors or lenses, the radiations from furnaces, gas, and oil lamps, or other artificial sources, provided the beams are carried in parallel rays and arrested within, say, 6 feet of the focus. I apprehend no difficulty in so utilizing the sun's rays, but am doubtful as to the gain of heat, in massing heat radiations from other sources. I would not require over 200° Fah. Can this be accomplished, and how? A. All heat rays are susceptible of accumulation by concentrated radiation, whether of the sun or of artificial combustion. Blackened surfaces constitute the best

radiators. Place a wire basket filled with a small shovel full of glowing coals in the focus of a reflector, and the heat rays from it will ignite phosphorus in the focus of a supplementary reflector 12 feet distant. A number of reflectors, so placed behind as many fires as to concentrate the heat rays upon a given point, will cause a degree of heat at that point corresponding in intensity with the combined rays of the fires, less the loss by absorption into the medium through which they pass. Light rays from the moon may be concentrated as readily as those from the sun, but no degree of multiplication of such rays will reveal any appreciable accumulation of heat. From this it is to be inferred that this reflected heat that what little of heat from the sun there may be, that is not absorbed by the moon, is lost on its way to us in its passage through the atmosphere of the earth.

In using compressed air, would there be any gain of power (without reference to the question of economy) by evaporizing and heating before compressing the air? A. If you heat the air at constant volume, before compressing it, the pressure will be increased; and then if it is compressed, the pressure will of course be greater than if it had not been previously heated.

(3) R. K. asks: What is the best material for locomotive boiler tubes for conducting heat, copper, brass, or iron? A. Brass.

(4) W. H. H. W. says: My neighbor has a well 40 feet deep and 800 feet from his house. The house is 10 feet lower than the bottom of well. Will it be possible to draw the water from the well by a siphon? Is it necessary to lower or cut away the hill that the water will not be required, to rise more than 30 feet. What size of pipe should be used? A. It will not be advisable to attempt to raise the water more than 25 or 30 feet, nor to use a pipe smaller than 1 inch in diameter.

(5) A. F. B. asks: Is it a saving of battery material for a Callaud gravity battery to stand open at night? A. Yes.

(6) J. T. B. asks: 1. Will electricity, passing through a magnet, change its poles? A. Yes. 2. Which is the cheapest way to run a strong electric battery? A. A carbon battery excited by bichromate of potash is the cheapest where great power is required.

(7) G. W. McD. asks: Does the air in the air chamber of an hydraulic ram change in the operation of the ram, that is, does more enter and some escape, in the working of the ram? A. Yes.

(8) C. C. J. R. asks: 1. If the circumference of a steel wheel be placed near a large magnet, does the wheel become a magnet? A. Yes. 2. Where are its poles situated? A. One pole would be next to the permanent magnet, the other would probably be on the opposite end of the wheel. 3. Does the horseshoe magnet of a magneto-electric machine lose its power by use? If so, is the loss much? A. Yes, gradually; but the loss is sometimes almost insensible for a long while. 4. Does it continue to lose as long as it is used? A. Yes. 5. How many revolutions ought a magneto-electric machine to make in a minute to produce the strongest current of electricity? A. The current will increase with most machines until the velocity of the movable magnets exceeds 1,000 revolutions. 6. Does a magnet lose its power when placed near the circumference of an iron or steel wheel which is revolving? A. Yes.

(9) W. N. M. says: I have the two conductors of an electrical machine, and the plate, shaft, and crank. There are no rubbers, and I want to know of what material to make them, and whether to put them between the wheel standards or on the same standard as the brass globe. A. Make the rubbers of leather and stuff them with horsehair. They should be attached to the standard carrying the brass globe.

(10) C. H. R. says: I notice in your accounts of the working of some of the many cables that electricians have experienced much difficulty in attaining a speed in the transmission of signals that was sufficient to relieve the pressure of business, and, in order to hasten it, have formed a metallic circuit by joining two wires, thereby overcoming in a measure the effects of the secondary current produced in the cable by the primary. I have often noticed in some of my experiments the strong natural tendency of the electricities when separated to reunite, and would suggest to electricians, if they think it worthy, a trial (my facilities in regard to the necessary apparatus being too limited for any conclusive experiments). If a vessel could be so constructed as to hold negative electricity (which could be accomplished by charging it, and drawing the positive to the ground), by attaching it to one end of the cable, and by working the opposite end with positive electricity, it might possibly not only hasten signaling, but overcome some of the other difficulties and make one cable free to work in opposite direction. A. The idea is impracticable for the reason that a signaler cannot operate opposite ends of the cable at the same instant.

(11) T. E. asks: What size of boiler should I use for a small engine, with 1 inch bore and 2 inches stroke? A. Make one 9 inches in diameter and 15 inches high.

(12) J. P. asks: How would you determine in horse power the best way steam heating should be charged? A. This must be a matter of argument, as there is no universal standard. A very common rating would be to charge the number of cubic feet of water evaporated per hour for heating purposes, as so much horse power. Others would multiply this by 2, to get the horse power.

(13) L. W. says: I am told that telegraph messages, in traveling from one station to another,

go through the ground, and that the wire serves to complete the circuit. Our operator says that the current passes over the wires, and that the ground wire serves to complete the circuit. A. The signals pass over the wire only. The earth merely completes the circuit by acting as a reservoir for the electricity discharged at each end of the wire.

(14) J. W. S. asks: 1. Is the actual pulling power of a locomotive engine with 4 feet driving wheels greater than with 5½ or 6 feet wheels, weight of locomotive, size of cylinder, and all other things being equal? A. Yes. 2. Why are small driving wheels generally adopted for freight locomotives? A. Because they are required to haul heavy loads, and great speed is not wanted.

(15) J. A. W. says: How much more will a screw 3 inches in diameter lift, than one 1½ inches, of the same pitch or number of threads per inch? A. Disregarding friction, the rule is as follows:

Weight raised: $\left\{ \begin{array}{l} \text{force} \\ \text{applied} \end{array} \right\} :: \left\{ \begin{array}{l} \text{circumference} \\ \text{described by} \end{array} \right\} : \left\{ \begin{array}{l} \text{pitch} \\ \text{of screw} \end{array} \right\}$

Hence the relation will be the same for all screws having the same pitch.

(16) W. S. W. asks: Is there any difference between an open crank motion or an eccentric motion? An eccentric motion is a solid crank, but the positiveness in the motion seems not to be the same. Are there the same dead points in an eccentric as there are in a crank? A. Yes, the motion is the same.

(17) F. C. W. asks: How many times will a locomotive cylinder fill and exhaust in a second? A. Take the case of a locomotive with 6 feet driving wheels, moving at the rate of 40 miles an hour. The wheels would make a little more than 3 revolutions per second, so that the cylinder would be filled a little over 6 times.

(18) H. W. K. asks: What is the process of tempering solid steel dies in lead? A. By heating steel in melted lead the outside becomes sufficiently hot to harden before the inside does; hence the inside is left comparatively soft, and the steel is therefore not liable to crack in the hardening. Another advantage is that the heating, and hence the tempering, is very uniform.

(19) W. C. A. asks: Will it make any difference in the working of a main telegraph line if I should use it for a return wire for a short circuit, putting keys, sounders, and local battery on the short circuit wire? A. It would not interfere with the working of the main line. Vocal sounds have been sent through a few feet of wire.

(20) J. W. S. says: Does steam at pressures from 40 to 125 lbs. per square inch destroy the elasticity of steel springs working in the boilers? A. Good springs are quite durable in such situations if they are protected against corrosion.

(21) E. W. W. says: I am building a cistern in my cellar with the inlet pipes each 2 inches in diameter, running from the roof, about 20 feet. How large should the outlet pipe be to prevent overflow? A. Make it 3 inches in diameter.

(22) A. R. asks: What is the formula for the number of feet in a telegraph pole? A. The following is given for timber measuring: $G = \frac{1}{4}$ girth at middle in feet. $g = \frac{1}{4}$ girth at one end in feet. $g' = \frac{1}{4}$ girth at other end in feet. $L =$ length of log in feet. $c =$ cube contents of same in feet.
$$c = L \left(\frac{G^2 + g^2 + g'^2}{3} \right)$$

(23) M. G. says: I have been trying to gold plate a chamber of a revolver. It had been nickel plated, but it had partly peeled off, so I took it all off. I cleaned it thoroughly, and to plate it with copper first I plunged it into a solution of sulphate of copper, and it turned all black. I would like to know what is the reason for this. A. Clean the chamber again carefully, and use a cyanide instead of an acid solution of copper for the first thin deposit. The superior chemistry of the acid for iron or steel over that of acid for copper is sufficient to produce the results obtained. Do not use too much battery.

(24) W. F. C. says: What is heat lightning? A. Heat lightning is a name given to the reflection of lightning discharges that take place below the horizon or behind clouds.

(25) A. R. W. asks: Can you give me a recipe for a phosphorus paste for cockroaches? A. Take phosphorus 1 oz., warm water 1 pint; put in a bottle, cork up, and agitate till the phosphorus is in a minute state of division, adding towards the end moist sugar $\frac{1}{4}$ lb. Then add lard melted by gentle heat 1 lb., and repeat the agitation till the whole is nearly cold; when cold, form it into a stiff dough with oatmeal, and make into small cakes. Dry in the air.

(26) I. E. H. asks: How can I make rubber stamps? A. Vulcanized rubber is used, as prepared by the manufacturers, and can be procured in strips about 3 inches wide and $\frac{1}{4}$ inch thick, and of any length desired. The name and address should be set up in type and well oiled; a rim about $\frac{1}{4}$ inch in height should be placed around the form, and dentist's plaster, mixed to the proper consistence, poured in and allowed to set; then the plaster cast is to be separated from the type. A piece of the vulcanized rubber is then cut out, of the size of the plaster mold, and laid upon it, and both together are placed in a screw press, and heat sufficient to thoroughly harden the rubber is applied. The screw is then turned down hard, and left for a time until the rubber is perfectly forced into the mold. After the whole is cold, the rubber is separated from the model, and any irregularities trimmed off with a sharp knife; the rubber stereotype is then fastened, with glue or other cement, to a block of wood, and the stamp is ready for use. 2. Of what is the well known oil bath for vulcanizing rubber

composed? A. At the present day Parkes' method is generally adopted; the caoutchouc is simply immersed in a mixture of 40 parts sulphide of carbon and 1 part chloride of sulphur; it is next placed in a room heated to 70° Fah., and, when all the sulphide of carbon has been volatilized, the process is so far complete that it is only requisite to boil the material in a solution of about 1 lb. caustic potassa in 2 gallons water, the vulcanized caoutchouc being next washed to remove excess of alkali.

(27) H. D. M. F. asks: What is a bogie? A. "A four-wheeled truck supporting the fore part of a locomotive, and turning beneath it to some extent, if necessary."—Knight's Mechanical Dictionary.

(28) C. D. K. asks: 1. How can I stain light yellow brick so as to give them a dark color? A. You cannot stain brick a permanent color as you can some kinds of wood. The nearest approach to it probably is the cement wash which permeates the pores of the brick. Something of the nature of a glaze might be fixed into the face of the brick in the kiln. Light brick may be made darker by smoke, but the color will be neither even nor agreeable. Cement or oil paint is the most practicable.

(29) C. M. asks: Would a moist blast for forges, etc., be injurious to the iron? A. No, but there would be no advantage derived from the introduction of moisture.

(30) C. F. G. asks: For what are barytes used? A. The sulphate of baryta is the permanent white of water color artists; it is also employed to adulterate white lead. When mingled in excess with the latter pigment it forms Dutch white; in equal quantity Hamburg, and in lesser amount Venice, white. But it becomes, when ground with oil, translucent, and impairs the opacity of the lead paint.

(31) O. J. H.—Paris green (Schweinfurt green) is an aceto-arsenite of copper. In 100 parts: oxide of copper, 31.29; arsenious acid, 55.05; acetic acid, 10.06. Dr. Ehrmann gives as its formula: $(C_2H_3O)_2 \cdot Cu + 3(CuO, As_2O_3)$.

(32) A. M. S. says: You stated some time ago that glycerin was a low form of alcohol. Some students tell me it is an oil. A. The alcohols are classified after the number of the O H, or hydroxyl, groups contained in them. Thus: ordinary alcohol (ethyl alcohol)— $C_2H_5(OH)$ —is a monatomic alcohol; $C_2H_4(OH)_2$, or ethylene alcohol, is diatomic; $C_2H_3(OH)_3$, or glycerine, is triatomic, etc. We do not know what you mean by "low form" of alcohol; glycerine, the last named alcohol, is more highly constituted than the former.

How are photographs fastened to glass for the new style of oil painting? A. Cover the picture with a fine cloth, and remove all air bubbles by means of a soft rubber roller.

(33) W. B. W. asks: How can I make a petrifying solution to make vegetable tissues hard and durable? A. The time required for ordinary petrification renders its artificial application impracticable. There are various methods of metalizing leaves, etc., usually by electro-deposition of the metal, which, when properly applied, copy perfectly. These may be afterwards enameled to suit.

(34) J. D. E. asks: 1. What are the sizes and distances apart of the lenses in the eyepiece illustrated in SCIENTIFIC AMERICAN SUPPLEMENT, vol. 17. A. For medium power, focus of 1st lens, 1.30 inch; focus of 2d lens, 1.30 inch; focus of 3d lens, 1.40 inch; focus of 4th lens, 1.40 inch. Distance between 1st and 2d lens, 1.73 inch; distance between 2d and 3d lens, 2.25 inch; distance between 3d and 4th lens, 1.47 inch. Diameter of 1st and 2d lens, 0.48 inch; diameter of 3d lens, 0.68 inch; diameter of 4th lens, 0.34 inch. Distance of diaphragm from 1st lens, 1.45 inch; aperture of diaphragm between 1st and 2d lens, 0.08 inch; aperture of diaphragm between 3d and 4th lens, 0.46 inch; distance of cap from 4th lens, 0.30 inch; aperture of cap, 0.17 inch. 2. Should there be a diaphragm at the focus of the object glass? A. There should be diaphragms in the tube to cut off the reflections from the inside. 3. What is the ratio between achromatic lenses of different focal? A. In telescopic objectives the magnifying power varies directly as the focal length. If the focal length is double, the magnifying power is double. 4. Is it necessary to have the focus of the field lens of the Huyghenian eyepiece longer than that of the eye lens? A. Yes. 5. Is it necessary to have the rays of light parallel when they enter the eye? A. They should be nearly enough parallel to enable the eye to bring the object to a focus.

(35) E. P. M. asks: How can I soften some such substance as black hard rubber so as to mold it into small round tickets, with letters on them? A. The rubber is usually formed into the shape desired while still soft and warm, before vulcanization.

(36) H. N. R. asks: 1. Which is the most powerful, a reflecting or refracting telescope? A. A refracting one. 2. Can I get one which will distinguish objects 16 miles distant for \$30? A. Yes. 3. Where can I get it? A. Address the opticians who advertise in our columns. 4. Would it be too long to carry? A. No. 5. Would it be a night as well as a day glass? A. Yes.

(37) A. L. F. asks: What is common pitch? A. It is the residue remaining after the removal of certain volatile bodies by distillation from the so-called Stockholm tar. The tar is originally obtained by a kind of rude distillation of the resinous wood of the pine, in turf-covered kilns.

(38) O. J. H. asks: What is Paris green? A. It is the aceto-arsenite of copper, and is the most poisonous of any of the combinations of arsenic.

(39) F. M. W. asks: Is there such an instrument as a night glass? A. The night glass (telescope), properly speaking, differs from the day glass only in the dimensions of its objectives and in some cases the use of an eyepiece of lower power. Ordinarily the so-called day and night glasses do not differ in any respect.

MINERALS, ETC.—Specimens have been received from the following correspondents and examined, with the results stated:

T. A. H.—Nos. 1, 2, and 3 are sulphide of iron. No. 4 is sand containing sulphide of iron, oxide of iron, alumina, and clay.—D. S. V.—It is chlorite with felspar, and is of no value.—J. S. M.—The presence of the sand is probably due to the decomposition of certain silicates at the source of the spring, the finely divided silica being brought to the surface by the mechanical force of the water, and there deposited. It is not of sufficient purity to be of value even for glass making.—S. S.—The powder consists principally of sesquioxide of iron, together with a little alumina and sand. We found neither gold nor silver.—P., of Gold Hill, Nevada.—It is a clay containing lime. We do not think it contains any metal in paying quantities. A complete analysis would be required to determine all its constituents.—W. H. W.—It is galena, sulphure of lead.—J. M.—The very small piece appears to be an artificial product. It contains a considerable percentage of copper.—J. McG.—A complete analysis of the beef did not detect any poisonous matter.—J. F. W.—No. 1 is mica schist. No. 2 is hornblende. No. 3 is chrysoprase-chalcedony, whose color is due to nickel. No. 4 is dolomite, a magnesian limestone. No. 5 is rutile—titanic acid. No. 6 is felspar mica. No. 7 is a variety of basalt. No. 8 is quartz. No. 9 is impure clay. No. 10 is granite. Nos. 11 and 13 are semi-decomposed granite. No. 12 is quartz. No. 14 is flint. No. 15 is clay containing iron. Nos. 16 and 17 are hornblende. No. 18 appears to be a specimen of chlorite, a silicate of magnesia. No. 19 is magnesian limestone.—E. E. Y.—It is a taconite rock containing sulphide of iron, which has gradually suffered partial decomposition; it is not valuable.—J. T.—It is an impure clay containing oxide of iron and sand.—A. W. S.—It contains, or has been in contact while heated with, sand or clay. The scoria consists of silicates of lime, alumina, and iron, together with caustic lime.—S. E. E.—No. 1 is hematite—an iron ore. No. 2 contains oxide of manganese.—No. 3 is hornblende.—R. C.—The yellow body is sulphide of iron. The white, carbonate of lime. The hard dark colored piece appears to be chalcedony. The fourth is a piece of scoria.—Cairo, Ill.—It is impure kaolin, a silicate of alumina.—The two specimens in match box, marked "Alpha" and "Beta," are quartz rock and hematite iron ore.

J. C. R. asks: In what year did the grasshoppers commence their destructive work in this country?—W. Z. R. and others ask: What is haltra, which you mention as a new size for cotton cloth?

COMMUNICATIONS RECEIVED.

The Editor of the *SCIENTIFIC AMERICAN* acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Accumulation of the World. By S. A. On Bevel Gears. By H. E.

Also inquiries and answers from the following: W. F. W.—L. W. P.—B. T. K.—P. F.—H. H.—J. B.—W. W. C.—F. M. J.—W. D. K.—W. K. P.—M. A. G.—E. G.—P. S. K.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes cast iron cannon? Who sells sensitive dry photographic plates? Whose is the best photographic apparatus for outdoor work? Who sells varnishes? Whose is the purest white lead?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

August 22, 1876.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Addressing machine, J. M. Kennard 181,370
Alarm, fire, A. F. Ellis 181,323
Auger, pest hole, L. R. Hitchcock 181,264
Bale tie, W. Wilkinson 181,395
Baling machine, etc., J. B. Archer 181,389
Barrel, D. F. Bowker 181,241
Bottle, aspool, Keese & Co. 181,269

Barrel stand, D. Scott 181,366
Bed bottom spring, W. S. Reynolds 181,517
Bedstead, wardrobe, C. Kilburn 181,450
Billiard chalk and ball holder, R. Martinez 181,354
Bluing, liquid laundry, T. S. Robinson 181,282
Bobbin, C. Hardy 181,486
Boiler attachment, C. M. Van Tine 181,501
Boiler, culinary, J. Bevin 181,396
Boiler flue brush, J. H. Davis 181,416
Boiler furnace, steam, B. J. Hobson 181,440
Boiler compound, scale-removing, R. E. Taylor 181,373
Boiling apparatus, J. H. Corey 181,349
Boots, making, Le Blanc & Co. 181,455
Boots, moccasins, S. T. Hutchins 181,444
Bridges, etc., raising, Clark & Co. 181,409
Brooms, J. F. Lee, Jr. 181,454
Buckle, P. Burns 181,407
Bung, W. W. Crocker 181,517
Bureau, J. Isakson 181,445
Burner, lamp, H. C. Scott 181,285
Butter worker, H. O. Mason 181,274
Candlestick, miner's, Quilven & Linebarger 181,362
Cans, labeling fruit, J. Hinkley 181,340
Car axle lubricator, J. B. Flynt 181,428
Car brake pad, Russell & Shank 181,452
Car coupling, C. Derrick 181,253
Car coupling, A. Scoles 181,484
Car, discharging, J. W. McDonald 181,460
Car, refrigerating, J. A. Ayer 181,391
Car unloader, grain, G. M. Moulton 181,496
Car ventilator, W. Foglesong 181,429
Car wheels, casting, N. Washburn 181,504
Cars, feed trough for stock, Z. Street 181,495
Cars, etc., heater for, M. W. Hazelton 181,437
Cars, etc., ventilating, W. S. Andrews 181,240
Cartridges, capping, Burton & Co. 181,306
Cartridge cases, making, I. M. Milbank 181,356
Cartridge shells, testing, Salisbury & Wells 181,364
Chain, ornamental, S. Davidson 181,417
Chain, ornamental, J. L. Heeley 181,438
Chain, ornamental, P. E. Withereil 181,511
Chain protector, lady's, H. Hayward 181,261
Chain, L. Blust 181,400
Chain, J. Campbell 181,311
Cigar mold, N. Du Brul (r) 7,269
Civilians, spring, J. F. Chase 181,313
Clod crusher and drag, H. Feenders 181,427
Clothes dryer, J. P. Howell 181,442
Clothes dryer, O. B. Lee 181,351
Clothes pounder, E. J. Pumphrey 181,474
Clothes wringer, F. Way 181,505
Cock, stop and waste, G. Veale, Jr. 181,502
Coloring cotton and wool, Rice & Arnold 181,479
Cooler, milk, W. H. Hyde 181,347
Corset, C. A. Griswold 181,330
Cotton cleaner, A. J. Lee 181,352
Crackers, packing case for, J. Garneau, Sr. 181,329
Cradle, wire, E. Rollett 181,481
Crib and table, M. C. Urquhart 181,292
Cultivator, J. C. Bannigan 181,302
Cultivator, C. L. Carter 181,245
Cultivator, D. C. Stover 181,404
Cutting index sheets, S. M. Simons 181,290
Dental foil, R. S. Williams 181,508
Dental plugger, Snow & Lewis (r) 7,274
Dentist's vulcanizer, J. L. McDermut (r) 7,275
Desk, writing, Keys & Taylor 181,449
Digger, potato, A. J. Nellis 181,467
Dividers, A. Gruber 181,331
Door fastener, J. D. King 181,271
Drawing board, S. James 181,348
Drill, rock, E. Winchester 181,396
Earth closet, J. W. Beyron 181,397
Earth closet, R. S. Williams 181,507
Earth pulverizer, J. M. Kendall 181,448
Egg box, G. W. Stevens 181,371
Electric machine, W. Hochhausen 181,342
Elevated way, H. W. Farley 181,436
Elevator and purifier, water, C. H. Hall 181,336
Elevator belts for buckets, F. H. C. Mey 181,353
Elevator, hod, W. Smith 181,498
Elevator, hydraulic, M. P. Higgins 181,263
Elevator tower, L. B. Sawyer 181,283
Elevator tripping bucket, coal, J. R. Fitzhugh 181,516
Embankments, forming, Swift & O'Neale 181,372
Engine, blowing, P. L. Weimer 181,395
Engine, steam, A. B. Cribfield 181,315
Engine balanced valve, J. Fairburn 181,325
Engine governor, J. D. Willoughby 181,509
Engine valve, steam-moved, A. J. Stevens 181,570
Fan, J. E. Young 181,513
Fare box, W. E. Prall 181,281
Fence, barbed, R. Ford 181,228
Fence wire, barbed, J. F. Glidden 181,433
Fertilizing, treating refuse for, J. Bonfield 181,402
Fiber, separating, J. B. Vogel 181,352
Fire arm, breech-loading, H. J. Altman 181,301
Fire extinguisher, J. H. Connelly 181,414
Fire place frame, Bagnis & Bell 181,306
Fires in oil tanks, extinguishing, J. H. Connelly 181,413
Fishing, trolling hook for, H. C. Brush 181,304
Furnace for assaying, T. M. Berge 181,304
Furnace gases, etc., purifying, Connelly & Co. (r) 7,268
Furnace, soldering, F. C. & C. E. Smith 181,499
Gage, carpenter's, C. H. B. Hutchinson 181,345
Gas and water pipe case, F. Jarocki 181,349
Gas apparatus, B. Dean 181,413
Gas, generating carbonic acid, A. Kayser 181,268
Gas burner, F. A. Seaver 181,485
Gas lighting, automatic, W. W. Hannah 181,360
Gas fixture, C. Y. Taylor 181,496
Gas making, H. W. C. Twiddle 181,499
Gas purifier, P. Munzinger 181,276
Glassware, press for molding, J. Haley 181,434
Grate, J. R. Case 181,246
Gun stock, adjustable, A. Sherman 181,289
Harness saddle and check hook, P. Burns 181,406
Harrow, A. J. Upham 181,579
Harvester, Rawson, Thacher & Rawson 181,477
Harvester, corn, Hunt & Bryan 181,443
Harvester, platform adjustment, S. Noxon, Jr. 181,289
Hay elevator, J. R. Fitzhugh 181,515
Hay tedder, W. C. Gifford (r) 7,270
Health lift, H. H. Everts 181,424
Heater, fire place, S. Musser 181,277
Heater for cars, etc., M. W. Hazelton 181,437
Hoe, wheel, R. Vampill 181,380
Hoof trimmer, G. Greiner 181,282
Horse detaching device, M. V. B. Walker 181,508
Horsehoes, removing burr from, C. H. Perkins 181,379
Hydrant, J. E. Scanlan 181,483
Hydrant, L. L. Treman 181,378
Hydro-extractor, W. P. Uhlinger 181,500
Ice crushing machine, D. W. Low 181,273
Illuminating apparatus, F. Darracott 181,352
Indicator, punching, W. Welch (r) 7,277
Indicator, station, C. O. Ficht 181,256
Injector, G. H. Little (r) 7,271
Jack, lifting, H. A. Curtis 181,251
Jack, wagon, F. A. Cleland 181,410
Kettle, camp, A. A. Gervais 181,431
Kiln, brick, E. W. Bingham 181,399
Ladder, extension step, W. H. Bitter 181,305
Lamp collar, C. F. Spencer 181,491
Lamp lighting attachment, R. Biber 181,398
Lamp wick and burner, H. C. Scott 181,284
Land roller marker, W. V. Aldridge 181,300
Lathes, chuck for metal, A. B. Smith 181,369
Leather, tapering machine, J. & G. W. Settle 181,499
Leggings, F. L. Oakley 181,469
Leveling rod, G. L. Whitehouse 181,284
Loom temple, E. S. Stimpson 181,291
Marble, artificial, R. Guelton 181,332
Marble, polishing, D. C. Myers 181,446
Mill, fulling, J. Draper 181,254
Mop holder, Cabbage & Alexander 181,415
Musical instrument, Smith & Hamilton 181,400
Nail extractor, W. H. Tinker 181,374
Nail feeding machine, F. Toepfer 181,376
Nail plate feeder, F. A. Gleason 181,258
Nut lock, T. C. Conrad 181,314
Nut lock, D. Deahon 181,419
Nut lock, C. H. Everhart 181,425
Ores, etc., roasting, smelting, J. Duffey 181,322
Organ tremolo, read, H. L. Pierce 181,472
Overalls, Crocker & Sommerfeld 181,316
Pail, lard, J. Sears 181,296
Pails, machine for stripping, S. R. Henry 181,336
Paper bag machine, C. H. Morgan (r) 7,273
Paper bag machine, S. E. Pettie (r) 7,275
Paper, composition paste for, J. Ralston 181,476
Paper-folding mechanism, L. C. Crowell 181,290
Paper pulp, saving alkali in, S. Brown 181,405
Pavement, S. Baird 181,392
Pea nut roaster, J. Esposito 181,324
Pen and pencil case, C. M. Johnson 181,447
Pipe molds, making, W. Smith 181,508
Plating machine, Robinson & Silsby 181,480
Plane, etc., tonguing, C. G. Miller 181,357
Planter and fertilizer, J. C. Fooseh 181,327
Planter, corn, Z. D. Waters 181,294
Plaster, seed, P. Kraus 181,350
Plastering tool, A. A. Howe 181,344
Plow, W. Stephenson 181,499
Plow beam, adjustable, J. Pentreath 181,471
Pop corn balls, forming, G. A. Blodgett 181,306
Power, transmitting, Williams & Carter 181,296
Press, cider, H. L. & S. M. Brown 181,243
Printed sheets, etc., receiving, J. D. Yost 181,367
Pulley or fly wheel clutch, R. A. York 181,514
Pump, J. S. Adams 181,299
Pump, G. W. Rhinehart 181,363
Pump, cattle, J. H. McConnell 181,459
Pump, chain, G. Blythe 181,401
Pump, chain, A. J. Purviance 181,473
Pump governor, J. S. Leas 181,452
Pump, steam, J. Cahill 181,408
Pump valve, W. H. Thomas 181,497
Pumping valve, for barrels, J. J. Lewis 181,457
Railway signal, electro-magnetic, Hall & Snow 181,435
Railway switch, W. E. Prall 181,280
Railway switch, link bar for, T. G. Armstrong 181,390
Rake, horse hay, H. H. Hatheway 181,337
Reel, twine, J. Clarke 181,247
Reflector, F. L. Senour 181,297
Refrigerator, J. F. Ferguson 181,326
Retort for distilling mercury, F. Gutzkow 181,333
Rolling rails, roll for, W. Evans 181,255
Sash holder, E. B. Hill 181,339
Saw buck, P. W. Hardwick 181,385
Saw, hand, Disston & Shoemaker 181,422
Saws, tab for gang, H. Disston 181,421
Sawing machine, firewood, W. A. Hodgkins 181,343
Sawing machine, lathe, J. W. Calkins 181,310
Separator, grain, R. M. Becker 181,303
Separator, grain, P. E. Merrihue 181,462
Separator, shavings, E. Brown 181,404
Settee, B. A. Osgood 181,360
Shaft coupling, R. Poole 181,473
Sharpening machine, McLaren & Coventry 181,275
Shelf, adjustable, E. C. Donnell 181,330
Shoe pegs, making, O. Abell 181,298
Sidewalk, T. Hyatt 181,346
Sieve, metallic, G. Herring 181,262
Sink guard and cover combined, A. S. Hodges 181,265
Skate, J. A. Dodge 181,319
Sled, Brannock & Cleveland 181,403
Sleigh knee and beam socket, J. J. Cobb 181,248
Sling for packages, G. D. Stevens 181,492
Smoothing iron, self-heating, J. S. Hull 181,366
Solder-cutting machine, F. C. & C. E. Smith 181,367
Soldering furnace, F. C. & C. E. Smith 181,499
Spooling yarn guide, G. Draper 181,321
Spooling guide supporter, J. B. Bancroft 181,384
Squaring tool, frame, J. Cleveland 181,411
Stamp, hand, P. Liebe 181,458
Steam or gas, absorbing noise of, T. Shaw 181,288
Stereoscope, Wilcox & Ryan 181,506
Stove, C. Baldwin 181,308
Stove pipe, G. Wright 181,297
Stove platform, M. De Yonge 181,420
Surveying instrument, W. Kuebler 181,451
Suspensory, J. B. Sharp 181,497
Tank, liquid-measuring, B. Williams 181,510
Teaching singing, G. C. Carrozzini 181,312
Telegraph signal box, J. H. C. Watts 181,385
Telegraph, perforator, G. L. Anders 181,239
Tobacco cutter, J. G. Perry 181,361
Tobacco, making plug, C. Worley 181,512
Toy cannon, S. B. Hibbard 181,341
Trap, animal, C. R. Jenne 181,446
Tube-stretching machine, J. T. Connelly 181,412
Tunnel, subaqueous, J. C. Trautwine 181,498
Twee, M. Lester 181,476
Twee, I. S. Van Winkle 181,381
Type-writing machine, G. H. Morgan 181,463
Umbrella drip cup, Vincent & McKinny (r) 7,276
Valve, balanced, L. H. Hall 181,334
Valve gear, G. A. C. Bremme 181,244
Valve, stop, C. Jenkins 181,367
Vehicle draft appliance, J. L. Mueller 181,358
Vehicle head block, Z. Fischesser 181,257
Vehicle hub, N. L. Holmes 181,441
Vehicle pole attachment, B. C. Bradley 181,307
Vehicle, trotting, A. Hitchcock 181,439
Vehicles, spring connection for, W. Evans 181,423
Velocipede, S. Glizinger 181,432
Veneers, cutting, J. D. McEachern 181,461
Ventilator, valve, W. Lane 181,272
Wagon brake, Adair & Babcock 181,398
Wagon brake lever, J. S. Fullerton 181,430
Wagon, manure, J. W. Town 181,375
Washing machine, S. Lindsay 181,353
Water, purifying, M. Noiden 181,468
Water wheel, Rector & Black 181,475
Water wheel, R. D. Sayre 181,365
Weather strip, H. R. Parker 181,470
Wells, lowering brick into, J. Campbell 181,244
Windmill, J. H. Painter 181,278
Windmill, G. H. Wallace 181,293
Window scaffold, H. C. Traphagen 181,377

Window screen, A. B. Davis 181,319

DESIGNS PATENTED.

9,449.—SHAWL PIN.—L. S. Beals, Astoria, N. Y.
9,450.—FOUNTAIN PENS.—J. W. Fluke, New York city.
9,451.—FOUNTAIN PENS.—J. W. Fluke, New York city.
9,452.—CARPETS.—J. Hamer, Dutchess county, N. Y.
9,453.—CARPETS.—A. Heald, Philadelphia, Pa.
9,454.—BELT.—M. Hild, Philadelphia, Pa.
9,455.—JACKET.—G. F. Hollis, Boston, Mass.
9,456 to 9,462.—CARRIAGE SEPS.—D. A. Kimbark, Chicago, Ill.
9,463.—SHIRT FRONTS.—A. Plant, New York city.
9,464 to 9,472.—FABRIC.—R. Scott & Co., Lawrence, Mass.

[A copy of any one of the above patents may be had by remitting one dollar to MUNN & Co., 37 Park Row, New York city.]

SCHEDULE OF PATENT FEES.

On each caveat \$10
On each Trade mark \$25
On filing each application for a Patent (17 years) \$15
On issuing each original Patent \$20
On appeal to Examiners-in-Chief \$10
On appeal to Commissioner of Patents \$20
On application for Reissue \$30
On filing a Disclaimer \$10
On an application for Design (3 1/2 years) \$10
On application for Design (7 years) \$15
On application for Design (14 years) \$30

THE VALIDITY OF PATENTS.

We recommend to every person who is about to purchase a patent, or about to commence the manufacture of any article under a license, to have the patent carefully examined by a competent party, and to have a research made in the Patent Office to see what the condition of the art was when the patent was issued. He should also see that the claims are so worded as to cover all the inventor was entitled to when his patent was issued; and it is still more essential that he be informed whether it is an infringement on some other existing patent. Parties desiring to have such searches made can have them done through the Scientific American Patent Agency, by giving the date of the patent and stating the nature of the information desired. For further information, address MUNN & CO., 37 PARK ROW, New York.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - \$1.00 a line.
Engravings may be made advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

SCIENTIFIC BOOKS.

Workshop Receipts, for the use of Manufacturers, Mechanics, and Scientific Amateurs. 8vo, cloth. \$2.00.

Algebra Self-Taught. By W. P. Higgs. 8vo, cloth. \$1.00.

Pocket-Book of Useful Formulas and Memoranda for Civil and Mechanical Engineers. By Guilford L. Moleworth, 18th edition. Revised with considerable additions, by the author. 32mo, roan. \$2.00.

* Catalogues free on application.

E. & F. N. SPON, 446 Broome St., N. Y.

AGENTS TO CONTROL TERRITORY FOR Eureka Button Fasteners. Patented 1876. No tool required. This is an article of merit, whereby an agent can build up a permanent trade. Circulars free. Samples (1/2 gross box, Nos. 1 & 2) 20 cents. W. L. URANN, Manufacturer, 21 Fulton Street, New York.

READ THIS—Agents are making big pay, selling a valuable work for mechanics, etc. New rules, tables, and receipts. 10,000 sold to mechanics. Send \$2 for book, &c., to CHAS. KINGSLEY, Pub., Clinton, Iowa.

WANTED—One good 3d hand Power Shears; One Press, suitable for punching and shearing; (3) five eighth bar iron; also a Drop Hammer, 16 to 18 lbs. bet. grooves; one 25 h.p. Engine and Tubular Boiler. Give description and price. Address A. B. & C., Box 1,000, New York Post Office.

WANTED—By a Practical Pattern Maker. Situation where general work is done. Steady place preferred. Distance no object. Address PATTERN MAKER, Corning, N. Y.

MANUFACTURERS AND PATENTEES having useful articles, suitable for the Hardware Trade, and desiring aid to manufacture and introduce the same, address P. P. PRATT, care PRATT & Co., Buffalo, N. Y. Small samples may be sent, same to be returned if desired.

STEEL NAME STAMPS, post paid, for 18c. per letter. S. Marks on Wood, Iron, and Steel. Agents Wanted. STEEL STAMP WORKS, 215 Chapel St., New Haven, Ct.

AN ENGINEER OF LARGE EXPERIENCE in the care and management of Cane and Beet Sugar Factories and Refineries, just returned from Europe, is open for an engagement. Address C. K., Box 124, Jersey City, N. J.

NO MONEY We will start you in a business you can make \$50 a week without capital easy and respectable for either sex. Agents Supply Co., 261 Bowery, N. Y.

FOR SALE—VALUABLE PATENT RIGHTS of a Safety Screw Steam Platform Elevator and of a Broom Starching Machine for Steam Laundries. Can be seen at the International Exposition. Also, one third interest in Franta's Steel Truss Extension or Flying Bridge. For full particulars, address L. STERNBERGER, 503 Market St., Philadelphia, Pa.

ALCOTT LATHES for Broom, Rake and Hoe Handles S. C. HILLS, 51 Cortlandt St., N. Y.

LADIES can make \$5 a day in their own city or town. Address ELLIS M'F'G Co., Waltham, Mass.

HOW TO BUILD CHEAP BOATS. By Pad-diefast. A series of articles showing how any person may build a boat, with economy. Each article is accompanied by drawings and diagrams, with minute directions, dimensions, &c.

No. 1. The Three-Dollar Skiff.—Directions for construction, with 7 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 25. Price 10 cts.
No. 2. The Five-Dollar Rowing Skiff.—With full directions for construction, 18 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 26. Price 10 cts.
No. 3. A Fourteen-Dollar Sailing Skiff.—With 11 illustrations. Full directions for construction of boat, center board, rudder, mast, sail, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 29. Price 10 cts.
No. 4. A Twelve-Dollar Row Boat.—14 illustrations. Illustrates the construction of a graceful ribbed boat, light weight. Shows the method of securing good lines, how to bend and arrange the ribs, dimensions of all the parts, and directions for construction in full. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 30. All the above numbers of Supplement to be had at this Office and of all News Dealers.

\$250 A MONTE—Agents wanted everywhere. Business honorable and first class. Particulars sent free. Address J. WORTH & CO., St. Louis, Mo.

Advertisements.

Back Page - \$1.00 a line.
Inside Page - 75 cents a line.
Engravings may head advertisements at the same rate
per line, by measurement, as the letter press. Ad-
vertisements must be received at publication office as
early as Friday morning & appear in next issue.

Correspondence invited. Old roofs (all kinds) promptly
repaired; new roofs laid by contract. Send for estimate.
[Agents Wanted.]

ROOFS.

Why not make your Roofs last a lifetime, and save the
expense of a new roof every 10 or 15 years. It can be
done: If you use Slate Paint, it will not only resist the
effects of water and wind, but shield you from Fire.

OLD ROOFS.

Protect your Buildings by using Slate Paint, which
neither cracks in winter nor runs in summer. Old shin-
gle roofs can be painted, looking much better, and last-
ing longer than new shingles without the paint, for one-
fourth the cost of re-shingling. On decayed shingles it
fills up the holes and pores, and gives a new substantial
roof, that lasts for years. Curled or warped shingles
it brings to their places and keeps them there. This paint
requires no heating, is applied with a brush and very or-
namental. It is chocolate color, when first applied, but
changes to a uniform slate color, and is to all intents
and purposes slate.

ON TIN OR IRON ROOFS.

The red color is the best paint in the world for durability.
It has a heavy body, is easily applied, expands by heat,
contracts by cold, dries slow, and never cracks nor scales.
One coat equals 4 of any other.

FIRE-PROOF NEW ROOFS.

Mills, foundries, factories, and dwellings a specialty.
Materials complete for a new steep or flat roof of Rubber
Roofing cost but about half the price of re-shingling.
For Private houses, barns, and buildings of all descrip-
tions, it is far superior to any other roofing in the world
for convenience in laying, and combines the ornament-
ation, appearance, durability, and fire-proof qualities of
slate, at one third the cost. No Tar or Gravel Used.
How to save re-shingling—stop leaks effectually and
cheaply in roofs of all kinds. A 100 page book free.
Write to-day, and mention SCIENTIFIC AMERICAN.

New York Slate Roofing Co. Limited.

Roofing Contractors, 5 Cedar St., N. Y.

Lathes, Planers, Shapers, Drills,
Gear & Bolt Cutters, &c. E. GOULD, Newark, N.J.

COMPRESSED AIR MOTIVE POWER.—For
particulars of the most recent practice, send 20 cents
for SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1
and 2, containing 5 engravings of the Compressed
Air Locomotive now in use in St. Gothard Tunnel
Works, with dimensions, etc.



[ESTABLISHED 1846.]

Munn & Co.'s Patent Offices.

The Oldest Agency for Soliciting Patents in the
United States.

THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this
agency, at home and abroad, than through any other in
the world.

They employ as their assistants a corps of the most ex-
perienced men as examiners, specification writers, and
draftsmen that can be found, many of whom have been
selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed them-
selves of Munn & Co.'s services in examining their in-
ventions and procuring their patents.

MUNN & CO., in connection with the publication of
the SCIENTIFIC AMERICAN, continue to examine in-
ventions, confer with inventors, prepare drawings, specifi-
cations, and assignments, attend to filing applications in
the Patent Office, paying the government fees, and
watch each case step by step while pending before the ex-
aminer. This is done through their branch office, corner
F and 7th streets, Washington. They also prepare and
file caveats, procure design patents, trademarks, and re-
issues, attend to rejected cases (prepared by the inventor
or other attorneys), procure copyrights, attend to in-
fringement, furnish copies of patents, and, in fact, attend
to every branch of patent business both in this and in for-
eign countries.

A special notice is made in the SCIENTIFIC AMER-
ICAN of all inventions patented through this agency, with
the name and residence of the patentee. Patents are of-
ten sold, in part or whole, to persons attracted to the in-
vention by such notice.

Patents obtained in Canada, England, France, Belgium,
Germany, Russia, Spain, Portugal, the British
Colonies, and all other countries where patents are
granted, at prices greatly reduced from former rates.
Send for pamphlet pertaining specially to foreign patents,
which states the cost, time granted, and the requirements
of each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to Novem-
ber 26, 1867, can be supplied with official copies at rea-
sonable cost, the price depending upon the extent of
drawings and length of specifications.

Any patent issued since November 27, 1867, at which
time the Patent Office commenced printing the drawings
and specifications, may be had by remitting to this of-
fice \$1.

A copy of the claims of any patent issued since 1836 will
be furnished for \$1.

When ordering copies, please to remit for the same as
above, and state name of patentee, title of invention,
and date of patent.

A pamphlet containing full directions for obtaining
United States patents sent free. A handsomely
bound Reference Book, gilt edges, contains 140 pages
and many engravings and tables important to every pa-
tentee and mechanic, and is a useful handbook of refer-
ence for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,

Publishers SCIENTIFIC AMERICAN,

37 Park Row, N. Y.

BRANCH OFFICE—Corner F and 7th Streets, Wash-
ington, D. C.

ROCK-DRILLING MACHINES
AND
AIR COMPRESSORS.

Manufactured by
BURLINGHAM ROCK DRILL CO.,
Send for Pamphlet. Pittsburg, Mass.

VELOCIPED CARRIAGES, OF LIGHT CON-
struction, fast speed. Worked by hand cranks,
also of foot treadle. Also of the SCIENTIFIC AMER-
ICAN SUPPLEMENT No. 8. To be had at this office
and of all news agents. Price 10 cents.

Diamond Solid Emery Wheels.

PRICES—\$254. \$1.25; \$21. \$2.25; 12x1 1/2, \$5.50; 18x2, \$12.00; 20x2, \$19.50; 24x3, \$42. All other sizes at pro-
portionate prices. Fast cutting, free from glazing, they
are the best Solid Emery Wheels. Give diam. of holes
in your order for wheels. Emery Grinders unequalled by
any in the world. Address AMERICAN TWIST DRILL
CO., Woonsocket, R. I.



HOUSTON
TURBINE
WATER WHEEL
IMPORTANT IMPROVEMENTS.
SEND FOR NEW CIRCULAR.
MERRILL & HOUSTON
IRON WORKS.
BELLEVILLE, WISCONSIN.

HANDASYDE'S COMPOSITION

For the Removal and Prevention of
Incrustation in Steam Boilers.
Used by the principal Railroads, Coal Mines, and Gen-
eral Manufacturers in Great Britain and Ireland. Satis-
faction guaranteed. The best and cheapest in the mar-
ket. Send for circular and testimonials.
G. C. CAMPBELL, AGENT,
24 Broadway, New York.

Diamonds & Carbon

shaped or Crude, furnished and set for Boring Rocks,
Dressing Mill Burrs, Emery Wheels, Grindstones, Hard-
ened Steel, Calendar Rollers, and for Sawing, Turning, or
Working Stone and other hard substances; also Glaziers'
Diamonds. J. DICKINSON, 64 Nassau St., New York.



Durable, and Efficient.

Send for Pamphlet and
Sample of work.
Improved Solid Steel Cutters for
all kinds of Variety Moulders
made to order, and warranted
by the
B. C. MACHINERY CO.,
Battle Creek, Mich.

SNYDER'S LITTLE GIANT STEAM ENGINE

The Best
One Horse Power with full
boiler complete only \$150.
Two Horse Power 200
Three Horse Power 250
Four Horse Power 300
Five Horse Power 350
Six Horse Power 400
Seven Horse Power 450
Eight Horse Power 500
Nine Horse Power 550
Ten Horse Power 600
Eleven Horse Power 650
Twelve Horse Power 700
Thirteen Horse Power 750
Fourteen Horse Power 800
Fifteen Horse Power 850
Sixteen Horse Power 900
Seventeen Horse Power 950
Eighteen Horse Power 1000
Nineteen Horse Power 1050
Twenty Horse Power 1100
Twenty One Horse Power 1150
Twenty Two Horse Power 1200
Twenty Three Horse Power 1250
Twenty Four Horse Power 1300
Twenty Five Horse Power 1350
Twenty Six Horse Power 1400
Twenty Seven Horse Power 1450
Twenty Eight Horse Power 1500
Twenty Nine Horse Power 1550
Thirty Horse Power 1600
Thirty One Horse Power 1650
Thirty Two Horse Power 1700
Thirty Three Horse Power 1750
Thirty Four Horse Power 1800
Thirty Five Horse Power 1850
Thirty Six Horse Power 1900
Thirty Seven Horse Power 1950
Thirty Eight Horse Power 2000
Thirty Nine Horse Power 2050
Forty Horse Power 2100
Forty One Horse Power 2150
Forty Two Horse Power 2200
Forty Three Horse Power 2250
Forty Four Horse Power 2300
Forty Five Horse Power 2350
Forty Six Horse Power 2400
Forty Seven Horse Power 2450
Forty Eight Horse Power 2500
Forty Nine Horse Power 2550
Fifty Horse Power 2600
Fifty One Horse Power 2650
Fifty Two Horse Power 2700
Fifty Three Horse Power 2750
Fifty Four Horse Power 2800
Fifty Five Horse Power 2850
Fifty Six Horse Power 2900
Fifty Seven Horse Power 2950
Fifty Eight Horse Power 3000
Fifty Nine Horse Power 3050
Sixty Horse Power 3100
Sixty One Horse Power 3150
Sixty Two Horse Power 3200
Sixty Three Horse Power 3250
Sixty Four Horse Power 3300
Sixty Five Horse Power 3350
Sixty Six Horse Power 3400
Sixty Seven Horse Power 3450
Sixty Eight Horse Power 3500
Sixty Nine Horse Power 3550
Seventy Horse Power 3600
Seventy One Horse Power 3650
Seventy Two Horse Power 3700
Seventy Three Horse Power 3750
Seventy Four Horse Power 3800
Seventy Five Horse Power 3850
Seventy Six Horse Power 3900
Seventy Seven Horse Power 3950
Seventy Eight Horse Power 4000
Seventy Nine Horse Power 4050
Eighty Horse Power 4100
Eighty One Horse Power 4150
Eighty Two Horse Power 4200
Eighty Three Horse Power 4250
Eighty Four Horse Power 4300
Eighty Five Horse Power 4350
Eighty Six Horse Power 4400
Eighty Seven Horse Power 4450
Eighty Eight Horse Power 4500
Eighty Nine Horse Power 4550
Ninety Horse Power 4600
Ninety One Horse Power 4650
Ninety Two Horse Power 4700
Ninety Three Horse Power 4750
Ninety Four Horse Power 4800
Ninety Five Horse Power 4850
Ninety Six Horse Power 4900
Ninety Seven Horse Power 4950
Ninety Eight Horse Power 5000
Ninety Nine Horse Power 5050
One Hundred Horse Power 5100
One Hundred One Horse Power 5150
One Hundred Two Horse Power 5200
One Hundred Three Horse Power 5250
One Hundred Four Horse Power 5300
One Hundred Five Horse Power 5350
One Hundred Six Horse Power 5400
One Hundred Seven Horse Power 5450
One Hundred Eight Horse Power 5500
One Hundred Nine Horse Power 5550
One Hundred Ten Horse Power 5600
One Hundred Eleven Horse Power 5650
One Hundred Twelve Horse Power 5700
One Hundred Thirteen Horse Power 5750
One Hundred Fourteen Horse Power 5800
One Hundred Fifteen Horse Power 5850
One Hundred Sixteen Horse Power 5900
One Hundred Seventeen Horse Power 5950
One Hundred Eighteen Horse Power 6000
One Hundred Nineteen Horse Power 6050
One Hundred Twenty Horse Power 6100
One Hundred Twenty One Horse Power 6150
One Hundred Twenty Two Horse Power 6200
One Hundred Twenty Three Horse Power 6250
One Hundred Twenty Four Horse Power 6300
One Hundred Twenty Five Horse Power 6350
One Hundred Twenty Six Horse Power 6400
One Hundred Twenty Seven Horse Power 6450
One Hundred Twenty Eight Horse Power 6500
One Hundred Twenty Nine Horse Power 6550
One Hundred Thirty Horse Power 6600
One Hundred Thirty One Horse Power 6650
One Hundred Thirty Two Horse Power 6700
One Hundred Thirty Three Horse Power 6750
One Hundred Thirty Four Horse Power 6800
One Hundred Thirty Five Horse Power 6850
One Hundred Thirty Six Horse Power 6900
One Hundred Thirty Seven Horse Power 6950
One Hundred Thirty Eight Horse Power 7000
One Hundred Thirty Nine Horse Power 7050
One Hundred Forty Horse Power 7100
One Hundred Forty One Horse Power 7150
One Hundred Forty Two Horse Power 7200
One Hundred Forty Three Horse Power 7250
One Hundred Forty Four Horse Power 7300
One Hundred Forty Five Horse Power 7350
One Hundred Forty Six Horse Power 7400
One Hundred Forty Seven Horse Power 7450
One Hundred Forty Eight Horse Power 7500
One Hundred Forty Nine Horse Power 7550
One Hundred Fifty Horse Power 7600
One Hundred Fifty One Horse Power 7650
One Hundred Fifty Two Horse Power 7700
One Hundred Fifty Three Horse Power 7750
One Hundred Fifty Four Horse Power 7800
One Hundred Fifty Five Horse Power 7850
One Hundred Fifty Six Horse Power 7900
One Hundred Fifty Seven Horse Power 7950
One Hundred Fifty Eight Horse Power 8000
One Hundred Fifty Nine Horse Power 8050
One Hundred Sixty Horse Power 8100
One Hundred Sixty One Horse Power 8150
One Hundred Sixty Two Horse Power 8200
One Hundred Sixty Three Horse Power 8250
One Hundred Sixty Four Horse Power 8300
One Hundred Sixty Five Horse Power 8350
One Hundred Sixty Six Horse Power 8400
One Hundred Sixty Seven Horse Power 8450
One Hundred Sixty Eight Horse Power 8500
One Hundred Sixty Nine Horse Power 8550
One Hundred Seventy Horse Power 8600
One Hundred Seventy One Horse Power 8650
One Hundred Seventy Two Horse Power 8700
One Hundred Seventy Three Horse Power 8750
One Hundred Seventy Four Horse Power 8800
One Hundred Seventy Five Horse Power 8850
One Hundred Seventy Six Horse Power 8900
One Hundred Seventy Seven Horse Power 8950
One Hundred Seventy Eight Horse Power 9000
One Hundred Seventy Nine Horse Power 9050
One Hundred Eighty Horse Power 9100
One Hundred Eighty One Horse Power 9150
One Hundred Eighty Two Horse Power 9200
One Hundred Eighty Three Horse Power 9250
One Hundred Eighty Four Horse Power 9300
One Hundred Eighty Five Horse Power 9350
One Hundred Eighty Six Horse Power 9400
One Hundred Eighty Seven Horse Power 9450
One Hundred Eighty Eight Horse Power 9500
One Hundred Eighty Nine Horse Power 9550
One Hundred Ninety Horse Power 9600
One Hundred Ninety One Horse Power 9650
One Hundred Ninety Two Horse Power 9700
One Hundred Ninety Three Horse Power 9750
One Hundred Ninety Four Horse Power 9800
One Hundred Ninety Five Horse Power 9850
One Hundred Ninety Six Horse Power 9900
One Hundred Ninety Seven Horse Power 9950
One Hundred Ninety Eight Horse Power 10000
One Hundred Ninety Nine Horse Power 10050
Two Hundred Horse Power 10100
Two Hundred One Horse Power 10150
Two Hundred Two Horse Power 10200
Two Hundred Three Horse Power 10250
Two Hundred Four Horse Power 10300
Two Hundred Five Horse Power 10350
Two Hundred Six Horse Power 10400
Two Hundred Seven Horse Power 10450
Two Hundred Eight Horse Power 10500
Two Hundred Nine Horse Power 10550
Two Hundred Ten Horse Power 10600
Two Hundred Eleven Horse Power 10650
Two Hundred Twelve Horse Power 10700
Two Hundred Thirteen Horse Power 10750
Two Hundred Fourteen Horse Power 10800
Two Hundred Fifteen Horse Power 10850
Two Hundred Sixteen Horse Power 10900
Two Hundred Seventeen Horse Power 10950
Two Hundred Eighteen Horse Power 11000
Two Hundred Nineteen Horse Power 11050
Two Hundred Twenty Horse Power 11100
Two Hundred Twenty One Horse Power 11150
Two Hundred Twenty Two Horse Power 11200
Two Hundred Twenty Three Horse Power 11250
Two Hundred Twenty Four Horse Power 11300
Two Hundred Twenty Five Horse Power 11350
Two Hundred Twenty Six Horse Power 11400
Two Hundred Twenty Seven Horse Power 11450
Two Hundred Twenty Eight Horse Power 11500
Two Hundred Twenty Nine Horse Power 11550
Two Hundred Thirty Horse Power 11600
Two Hundred Thirty One Horse Power 11650
Two Hundred Thirty Two Horse Power 11700
Two Hundred Thirty Three Horse Power 11750
Two Hundred Thirty Four Horse Power 11800
Two Hundred Thirty Five Horse Power 11850
Two Hundred Thirty Six Horse Power 11900
Two Hundred Thirty Seven Horse Power 11950
Two Hundred Thirty Eight Horse Power 12000
Two Hundred Thirty Nine Horse Power 12050
Two Hundred Forty Horse Power 12100
Two Hundred Forty One Horse Power 12150
Two Hundred Forty Two Horse Power 12200
Two Hundred Forty Three Horse Power 12250
Two Hundred Forty Four Horse Power 12300
Two Hundred Forty Five Horse Power 12350
Two Hundred Forty Six Horse Power 12400
Two Hundred Forty Seven Horse Power 12450
Two Hundred Forty Eight Horse Power 12500
Two Hundred Forty Nine Horse Power 12550
Two Hundred Fifty Horse Power 12600
Two Hundred Fifty One Horse Power 12650
Two Hundred Fifty Two Horse Power 12700
Two Hundred Fifty Three Horse Power 12750
Two Hundred Fifty Four Horse Power 12800
Two Hundred Fifty Five Horse Power 12850
Two Hundred Fifty Six Horse Power 12900
Two Hundred Fifty Seven Horse Power 12950
Two Hundred Fifty Eight Horse Power 13000
Two Hundred Fifty Nine Horse Power 13050
Two Hundred Sixty Horse Power 13100
Two Hundred Sixty One Horse Power 13150
Two Hundred Sixty Two Horse Power 13200
Two Hundred Sixty Three Horse Power 13250
Two Hundred Sixty Four Horse Power 13300
Two Hundred Sixty Five Horse Power 13350
Two Hundred Sixty Six Horse Power 13400
Two Hundred Sixty Seven Horse Power 13450
Two Hundred Sixty Eight Horse Power 13500
Two Hundred Sixty Nine Horse Power 13550
Two Hundred Seventy Horse Power 13600
Two Hundred Seventy One Horse Power 13650
Two Hundred Seventy Two Horse Power 13700
Two Hundred Seventy Three Horse Power 13750
Two Hundred Seventy Four Horse Power 13800
Two Hundred Seventy Five Horse Power 13850
Two Hundred Seventy Six Horse Power 13900
Two Hundred Seventy Seven Horse Power 13950
Two Hundred Seventy Eight Horse Power 14000
Two Hundred Seventy Nine Horse Power 14050
Two Hundred Eighty Horse Power 14100
Two Hundred Eighty One Horse Power 14150
Two Hundred Eighty Two Horse Power 14200
Two Hundred Eighty Three Horse Power 14250
Two Hundred Eighty Four Horse Power 14300
Two Hundred Eighty Five Horse Power 14350
Two Hundred Eighty Six Horse Power 14400
Two Hundred Eighty Seven Horse Power 14450
Two Hundred Eighty Eight Horse Power 14500
Two Hundred Eighty Nine Horse Power 14550
Two Hundred Ninety Horse Power 14600
Two Hundred Ninety One Horse Power 14650
Two Hundred Ninety Two Horse Power 14700
Two Hundred Ninety Three Horse Power 14750
Two Hundred Ninety Four Horse Power 14800
Two Hundred Ninety Five Horse Power 14850
Two Hundred Ninety Six Horse Power 14900
Two Hundred Ninety Seven Horse Power 14950
Two Hundred Ninety Eight Horse Power 15000
Two Hundred Ninety Nine Horse Power 15050
Three Hundred Horse Power 15100
Three Hundred One Horse Power 15150
Three Hundred Two Horse Power 15200
Three Hundred Three Horse Power 15250
Three Hundred Four Horse Power 15300
Three Hundred Five Horse Power 15350
Three Hundred Six Horse Power 15400
Three Hundred Seven Horse Power 15450
Three Hundred Eight Horse Power 15500
Three Hundred Nine Horse Power 15550
Three Hundred Ten Horse Power 15600
Three Hundred Eleven Horse Power 15650
Three Hundred Twelve Horse Power 15700
Three Hundred Thirteen Horse Power 15750
Three Hundred Fourteen Horse Power 15800
Three Hundred Fifteen Horse Power 15850
Three Hundred Sixteen Horse Power 15900
Three Hundred Seventeen Horse Power 15950
Three Hundred Eighteen Horse Power 16000
Three Hundred Nineteen Horse Power 16050
Three Hundred Twenty Horse Power 16100
Three Hundred Twenty One Horse Power 16150
Three Hundred Twenty Two Horse Power 16200
Three Hundred Twenty Three Horse Power 16250
Three Hundred Twenty Four Horse Power 16300
Three Hundred Twenty Five Horse Power 16350
Three Hundred Twenty Six Horse Power 16400
Three Hundred Twenty Seven Horse Power 16450
Three Hundred Twenty Eight Horse Power 16500
Three Hundred Twenty Nine Horse Power 16550
Three Hundred Thirty Horse Power 16600
Three Hundred Thirty One Horse Power 16650
Three Hundred Thirty Two Horse Power 16700
Three Hundred Thirty Three Horse Power 16750
Three Hundred Thirty Four Horse Power 16800
Three Hundred Thirty Five Horse Power 16850
Three Hundred Thirty Six Horse Power 16900
Three Hundred Thirty Seven Horse Power 16950
Three Hundred Thirty Eight Horse Power 17000
Three Hundred Thirty Nine Horse Power 17050
Three Hundred Forty Horse Power 17100
Three Hundred Forty One Horse Power 17150
Three Hundred Forty Two Horse Power 17200
Three Hundred Forty Three Horse Power 17250
Three Hundred Forty Four Horse Power 17300
Three Hundred Forty Five Horse Power 17350
Three Hundred Forty Six Horse Power 17400
Three Hundred Forty Seven Horse Power 17450
Three Hundred Forty Eight Horse Power 17500
Three Hundred Forty Nine Horse Power 17550
Three Hundred Fifty Horse Power 17600
Three Hundred Fifty One Horse Power 17650
Three Hundred Fifty Two Horse Power 17700
Three Hundred Fifty Three Horse Power 17750
Three Hundred Fifty Four Horse Power 17800
Three Hundred Fifty Five Horse Power 17850
Three Hundred Fifty Six Horse Power 17900
Three Hundred Fifty Seven Horse Power 17950
Three Hundred Fifty Eight Horse Power 18000
Three Hundred Fifty Nine Horse Power 18050
Three Hundred Sixty Horse Power 18100
Three Hundred Sixty One Horse Power 18150
Three Hundred Sixty Two Horse Power 18200
Three Hundred Sixty Three Horse Power 18250
Three Hundred Sixty Four Horse Power 18300
Three Hundred Sixty Five Horse Power 18350
Three Hundred Sixty Six Horse Power 18400
Three Hundred Sixty Seven Horse Power 18450
Three Hundred Sixty Eight Horse Power 18500
Three Hundred Sixty Nine Horse Power 18550
Three Hundred Seventy Horse Power 18600
Three Hundred Seventy One Horse Power 18650
Three Hundred Seventy Two Horse Power 18700
Three Hundred Seventy Three Horse Power 18750
Three Hundred Seventy Four Horse Power 18800
Three Hundred Seventy Five Horse Power 18850
Three Hundred Seventy Six Horse Power 18900
Three Hundred Seventy Seven Horse Power 18950
Three Hundred Seventy Eight Horse Power 19000
Three Hundred Seventy Nine Horse Power 19050
Three Hundred Eighty Horse Power 19100
Three Hundred Eighty One Horse Power 19150
Three Hundred Eighty Two Horse Power 19200
Three Hundred Eighty Three Horse Power 19250
Three Hundred Eighty Four Horse Power 19300
Three Hundred Eighty Five Horse Power 19350
Three Hundred Eighty Six Horse Power 19400
Three Hundred Eighty Seven Horse Power 19450
Three Hundred Eighty Eight Horse Power 19500
Three Hundred Eighty Nine Horse Power 19550
Three Hundred Ninety Horse Power 19600
Three Hundred Ninety One Horse Power 19650
Three Hundred Ninety Two Horse Power 19700
Three Hundred Ninety Three Horse Power 19750
Three Hundred Ninety Four Horse Power 19800
Three Hundred Ninety Five Horse Power 19850
Three Hundred Ninety Six Horse Power 19900
Three Hundred Ninety Seven Horse Power 19950
Three Hundred Ninety Eight Horse Power 20000
Three Hundred Ninety Nine Horse Power 20050
Four Hundred Horse Power 20100
Four Hundred One Horse Power 20150
Four Hundred Two Horse Power 20200
Four Hundred Three Horse Power 20250
Four Hundred Four Horse Power 20300
Four Hundred Five Horse Power 20350
Four Hundred Six Horse Power 20400
Four Hundred Seven Horse Power 20450
Four Hundred Eight Horse Power 20500
Four Hundred Nine Horse Power 20550
Four Hundred Ten Horse Power 20600
Four Hundred Eleven Horse Power 20650
Four Hundred Twelve Horse Power 20700
Four Hundred Thirteen Horse Power 20750
Four Hundred Fourteen Horse Power 20800
Four Hundred Fifteen Horse Power 20850
Four Hundred Sixteen Horse Power 20900
Four Hundred Seventeen Horse Power 20950
Four Hundred Eighteen Horse Power 21000
Four Hundred Nineteen Horse Power 21050
Four Hundred Twenty Horse Power 21100
Four Hundred Twenty One Horse Power 21150
Four Hundred Twenty Two Horse Power 21200
Four Hundred Twenty Three Horse Power 21250
Four Hundred Twenty Four Horse Power 21300
Four Hundred Twenty Five Horse Power 21350
Four Hundred Twenty Six Horse Power 21400
Four Hundred Twenty Seven Horse Power 21450
Four Hundred Twenty Eight Horse Power 21500
Four Hundred Twenty Nine Horse Power 21550
Four Hundred Thirty Horse Power 21600
Four Hundred Thirty One Horse Power 21650
Four Hundred Thirty Two Horse Power 21700
Four Hundred Thirty Three Horse Power 21750
Four Hundred Thirty Four Horse Power 21800
Four Hundred Thirty Five Horse Power 21850
Four Hundred Thirty Six Horse Power 21900
Four Hundred Thirty Seven Horse Power 21950
Four Hundred Thirty Eight Horse Power 22000
Four Hundred Thirty Nine Horse Power 22050
Four Hundred Forty Horse Power 22100
Four Hundred Forty One Horse Power 22150
Four Hundred Forty Two Horse Power 22200
Four Hundred Forty Three Horse Power 22250
Four Hundred Forty Four Horse Power 22300
Four Hundred Forty Five Horse Power 22350
Four Hundred Forty Six Horse Power 22400
Four Hundred Forty Seven Horse Power 22450
Four Hundred Forty Eight Horse Power 22500
Four Hundred Forty Nine Horse Power 22550
Four Hundred Fifty Horse Power 22600
Four Hundred Fifty One Horse Power 22650
Four Hundred Fifty Two Horse Power 22700
Four Hundred Fifty Three Horse Power 22750
Four Hundred Fifty Four Horse Power 22800
Four Hundred Fifty Five Horse Power 22850
Four Hundred Fifty Six Horse Power 22900
Four Hundred Fifty Seven Horse Power 22950
Four Hundred Fifty Eight Horse Power 23000
Four Hundred Fifty Nine Horse Power 23050
Four Hundred Sixty Horse Power 23100
Four Hundred Sixty One Horse Power 23150
Four Hundred Sixty Two Horse Power 23200
Four Hundred Sixty Three Horse Power 23250
Four Hundred Sixty Four Horse Power 23300
Four Hundred Sixty Five Horse Power 23350
Four Hundred Sixty Six Horse Power 23400
Four Hundred Sixty Seven Horse Power 23450
Four Hundred Sixty Eight Horse Power 23500
Four Hundred Sixty Nine Horse Power 23550
Four Hundred Seventy Horse Power 23600
Four Hundred Seventy One Horse Power 23650
Four Hundred Seventy Two Horse Power 23700
Four Hundred Seventy Three Horse Power 23750
Four Hundred Seventy Four Horse Power 23800
Four Hundred Seventy Five Horse Power 23850
Four Hundred Seventy Six Horse Power 23900
Four Hundred Seventy Seven Horse Power 23950
Four Hundred Seventy Eight Horse Power 24000
Four Hundred Seventy Nine Horse Power 24050
Four Hundred Eighty Horse Power 24100
Four Hundred Eighty One Horse Power 24150
Four Hundred Eighty Two Horse Power 24200
Four Hundred Eighty Three Horse Power 24250
Four Hundred Eighty Four Horse Power 24300
Four Hundred Eighty Five Horse Power 24350
Four Hundred Eighty Six Horse Power 24400
Four Hundred Eighty Seven Horse Power 24450
Four Hundred Eighty Eight Horse Power 24500
Four Hundred Eighty Nine Horse Power 24550
Four Hundred Ninety Horse Power 24600
Four Hundred Ninety One Horse Power 24650
Four Hundred Ninety Two Horse Power 24700
Four Hundred Ninety Three Horse Power 24750
Four Hundred Ninety Four Horse Power 24800
Four Hundred Ninety Five Horse Power 24850
Four Hundred Ninety Six Horse Power 24900
Four Hundred Ninety Seven Horse Power 24950
Four Hundred Ninety Eight Horse Power 25000
Four Hundred Ninety Nine Horse Power 25050
Five Hundred Horse Power 25100
Five Hundred One Horse Power 25150
Five Hundred Two Horse Power 25200
Five Hundred Three Horse Power 25250
Five Hundred Four Horse Power 25300
Five Hundred Five Horse Power 25350
Five Hundred Six Horse Power 25400
Five Hundred Seven Horse Power 25450
Five Hundred Eight Horse Power 25500
Five Hundred Nine Horse Power 25550
Five Hundred Ten Horse Power 25600
Five Hundred Eleven Horse Power 25650
Five Hundred Twelve Horse Power 25700
Five Hundred Thirteen Horse Power 25750
Five Hundred Fourteen Horse Power 25800
Five Hundred Fifteen Horse Power 25850
Five Hundred Sixteen Horse Power 25900
Five Hundred Seventeen Horse Power 25950
Five Hundred Eighteen Horse Power 26000
Five Hundred Nineteen Horse Power 26050
Five Hundred Twenty Horse Power 26100
Five Hundred Twenty One Horse Power 26150
Five Hundred Twenty Two Horse Power 26200
Five Hundred Twenty Three Horse Power 26250
Five Hundred Twenty Four Horse Power 26300
Five Hundred Twenty Five Horse Power 26350
Five Hundred Twenty Six Horse Power 26400
Five Hundred Twenty Seven Horse Power 26450
Five Hundred Twenty Eight Horse Power 26500
Five Hundred Twenty Nine Horse Power 26550
Five Hundred Thirty Horse Power 26600
Five Hundred Thirty One Horse Power 26650
Five Hundred Thirty Two Horse Power 26700
Five Hundred Thirty Three Horse Power 26750
Five Hundred Thirty Four Horse Power 26800
Five Hundred Thirty Five Horse Power 26850
Five Hundred Thirty Six Horse Power 26900
Five Hundred Thirty Seven Horse Power 26950
Five Hundred Thirty Eight Horse Power 27000
Five Hundred Thirty Nine Horse Power 27050
Five Hundred Forty Horse Power 27100
Five Hundred Forty One Horse Power 27150
Five Hundred Forty Two Horse Power 27200
Five Hundred Forty Three Horse Power 27250
Five Hundred Forty Four Horse Power 27300
Five Hundred Forty Five Horse Power 27350
Five Hundred Forty Six Horse Power 27400
Five Hundred Forty Seven Horse Power 27450
Five Hundred Forty Eight Horse Power 27500
Five Hundred Forty Nine Horse Power 27550
Five Hundred Fifty Horse Power 27600
Five Hundred Fifty One Horse Power 27650
Five Hundred Fifty Two Horse Power 27700
Five Hundred Fifty Three Horse Power 27750
Five Hundred Fifty Four Horse Power 27800
Five Hundred Fifty Five Horse Power 27850
Five Hundred Fifty Six Horse Power 27900
Five Hundred Fifty Seven Horse Power 27950
Five Hundred Fifty Eight Horse Power 28000
Five Hundred Fifty Nine Horse Power 28050
Five Hundred Sixty Horse Power 28100
Five Hundred Sixty One Horse Power 28150
Five Hundred Sixty Two Horse Power 28200
Five Hundred Sixty Three Horse Power 28250
Five Hundred Sixty Four Horse Power 28300
Five Hundred Sixty Five Horse Power 28350
Five Hundred Sixty Six Horse Power 28400
Five Hundred Sixty Seven Horse Power 28450
Five Hundred Sixty Eight Horse Power 28500
Five Hundred Sixty Nine Horse Power 28550
Five Hundred Seventy Horse Power 28600
Five Hundred Seventy One Horse Power 28650
Five Hundred Seventy Two Horse Power 28700
Five Hundred Seventy Three Horse Power 28750
Five Hundred Seventy Four Horse Power 28800
Five Hundred Seventy Five Horse Power 28850
Five Hundred Seventy Six Horse Power 28900
Five Hundred Seventy Seven Horse Power 28950
Five Hundred Seventy Eight Horse Power 29000
Five Hundred Seventy Nine Horse Power 29050
Five Hundred Eighty Horse Power 29100
Five Hundred Eighty One Horse Power 29150
Five Hundred Eighty Two Horse Power 29200
Five Hundred Eighty Three Horse Power 29250
Five Hundred Eighty Four Horse Power 29300
Five Hundred Eighty Five Horse Power 29350
Five Hundred Eighty Six Horse Power 29400
Five Hundred Eighty Seven Horse Power 29450
Five Hundred Eighty Eight Horse Power 29500
Five Hundred Eighty Nine Horse Power 29550
Five Hundred Ninety Horse Power 29600
Five Hundred Ninety One Horse Power 29650
Five Hundred Ninety Two Horse Power 29700
Five Hundred Ninety Three Horse Power 29750
Five Hundred Ninety Four Horse Power 29800
Five Hundred Ninety Five Horse Power 29850
Five Hundred Ninety Six Horse Power 29900
Five Hundred Ninety Seven Horse Power 29950
Five Hundred Ninety Eight Horse Power 30000
Five Hundred Ninety Nine Horse Power 30050
Six Hundred Horse Power 30100
Six Hundred One Horse Power 30150
Six Hundred Two Horse Power 30200
Six Hundred Three Horse Power 30250
Six Hundred Four Horse Power 30300
Six Hundred Five Horse Power 303